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[OFFICIAL NOTICE.]

### Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF SECRETARY, NEW ALBANY, IND., February 5th, 1897.

All members of the Western Gas Association who contemplate contributions to the "Wrinkle Department" should forward them, before March 20th, to its Editor, Mr. George Treadway Thompson, No. 40 Wall street, New York city.

It is hoped that many will avail themselves of the opportunity to assist in keeping this most interesting and instructing department up to its usual standard.

Members will please act promptly and forward "Wrinkles" without further solicitation. JAMES W. DUNBAR, Secretary.

[OFFICIAL NOTICE.]

### March Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, March 5, 1897.

The March meeting of the Society of Gas Lighting will be held in the Arena, No. 39 West 31st street, New York city, at 3 P.M., of the 11th inst. FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

### March Meeting, Guild of Gas Managers.

OFFICE OF THE SECRETARY, March 6, 1897.

The March meeting of the Guild of Gas Managers will be held in Young's Hotel, Boston, Mass., at noon of Saturday, the 13th inst.

A. K. QUINN, Secretary.

## BRIEFLY TOLD.

CONGRESS AND COAL TAR.—The agitation in respect of restoring coal tar and pitch to a place on the dutiable list, from which they were removed, if we mistake not, by those who framed the celebrated "McKinley Bill," is assuming strength and cogency, and the gas interest evidently proposes to see to it that, if the materials which enter into the construction of their plants are protected, some of the products of those plants will share in whatever benefit proceeds from protection. If a duty (and we think it is just that such an impost should be made) is to go in the case of foreign coals, it would seem equally certain that a duty should be imposed on the products of such coals, for the whole should be no greater than its parts, nor should the parts receive different treatment than the mass—at any rate in the instance of rating either or all for tariff purposes. The right thing for gas men to do at this juncture is to appeal, by every means and method at their command, to their local representatives in the new Congress, for redress in this instance; and we make no doubt that such tugging would eventually haul the legislators to the point where the just demands of the industry would be recognized. The soundness of their claim is so

manifest that its simple naming would go a long way towards achieving their purpose; and we would and do here urge the responsible men in every gas company in the country to put this matter in its proper and true light before the respective representatives of their Congressional districts. United effort in this direction, from our standpoint, cannot result in else than success; and the result in sight is well worth striving for.

MR. SNOW'S PAPER ON GAS DISTRIBUTION.—Our current chapters of the proceedings of the 27th annual meeting of the New England Association contain a paper by Mr. W. H. Snow, of Holyoke, Mass., whose sensible lines on "Gas Distribution" will no doubt be read with interest. The author should be well satisfied that that which he had to say went home to his hearers, for the discussion of his paper was extended and full of the recital of several "home" experiences. The relative merits of cast and wrought iron and "soft" steel pipes for distributing purposes were quite thoroughly threshed; but as any of these materials may be considered each to have its advocates, which advocacy could not result in the belief by anyone that each sort of pipe did not have merit and worth, and would answer fairly well the purpose for which it was used, we will in these particulars allow the discussion to speak for itself. In the instance, however, of fiber pipe, we would just say the simple word that "conservatism" over its adoption is likely to prove the safest course. Every thing and system must, of course, be tried ultimately by the test of time, and in the instance of fiber pipe we may say that certain trials of it, on a fairly large scale and in divers ways, are being made, the outcome of which, we have reason to believe, will in due time come to us, and through us to the fraternity at large.

THE WESTERN ASSOCIATION'S WRINKLE DEPARTMENT.—The members of the Western Gas Association should remember that the next meeting of that vigorous organization is rapidly approaching; and they should also bear in mind that if its "Wrinkle Department" is to be of the high order of interest which has characterized it since its inception, contributions on that account should be forwarded to Editor Thompson without delay. The editing of such matter, to be done well, should not be done hurriedly; so the sooner the Wrinkles are sent to him the better it will be for the Association and the Editor.

NOTES.—The business of the Berlin Iron Bridge Company, of East Berlin, Conn., has increased so much that Mr. Charles M. Jarvis, who has been Chief Engineer of the Company since its organization, has been obliged to resign to others the engineering department and give his entire time and attention to the business management of the corporation. The Directors have selected for the position of Chief Engineer Mr. James H. Edwards, a graduate of Cornell University. Mr. Edwards has been with the Company for a number of years, acting in the capacity of chief assistant to Mr. Jarvis. The appointee is by education and experience well qualified for his new and important position. ——Mr. A. H. Barret, Vice-President and Engineer of the Louisville (Ky.) Gas Company, has just returned from a short European trip, taken for the purpose of inspecting the practical working abroad of the inclined retort system. It looks to us that the outcome of his visit will be the construction this spring in Louisville of a new retort house, equipped in accordance with the inclined plan.——The Westerly (R. I.) Gas and Electric Light Company has contracted with the United Gas Improvement Company for one of its standard junior Lowe water gas settings, with a daily capacity of 100,000 cubic feet, together with the necessary oil storage tanks. The coal gas plant will be discontinued. ——Mr. W. H. Winslow, Secretary of the Superior (Wis.) Water, Light and Power Company, writing to us from Superior, under date of the 2d inst., has this query to make: "The Superior Water, Light and Power Company, of West Superior, Wis., desires manufacturers of independent water heaters (gas) to send their price lists, with discounts and information as to the performance, economy, etc., of their apparatus." Perhaps the manufacturers might find it advantageous to set forth the especial values of the apparatus inquired for by Secretary Winslow in our advertising columns.——The following unique practice in billing customers has been instituted by the Spokane (Wash.) Gas Company: "*Resolved*, That from March 1 the following modifications shall take place in the scale of charges for gas: For light or fuel, $2.50 per 1,000 cubic feet, with 10 per cent. discount if paid before the 20th of the month. For light or fuel, $2.50 per 1,000 cubic feet, and 20 per cent. discount if paid before the 10th of the month."——Last month Mr. V. L. Elbert, of the Menominee (Mich.) Gas and Fuel Company, delivered an excellent address before the local High School on the subject of gas manufacture and distribution. Later on the Senior Class of the School inspected the gas works, under Mr. Elbert's direction.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—Continued from page 326.]

## PROCEEDINGS, TWENTY-SEVENTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD IN YOUNG'S HOTEL, BOSTON, MASS., FEB. 17 AND 18, 1897.

FIRST DAY, FEB. 17.—MORNING SESSION.

The President introduced Mr. William H. Snow, of Holyoke, Mass., who read the following paper on

### GAS DISTRIBUTION.

My only apology for the following infliction is the draft laid upon me by our Secretary. In all our New England States we have restrictive game laws, and in case of a threatened extinction of any line of game, a "close season" is inaugurated for a term of years. It would perhaps be well in our Association to pattern after them, and have a "close season," for all of our hunted and much harried subjects for papers, of say from five to ten years; then we could tackle them once more with renewed interest. What with the new questions that would arise meanwhile, and the new forms the old ones would assume, the berth of Secretary would be a sinecure; we would all rush into typewriter print and demand to be heard. But as it is with the present we have to do, and without someone or something to combat a meeting would lose much of its interest, I cheerfully offer myself for the sacrifice.

In no other department of our business are we brought into so intimate relations with our customers as through our system of distribution. Manifold are the ways in which we are connected with their comfort and convenience. In furnishing them with ample supply, accomplishing it with as little inconvenience to them as possible, in digging up their streets and lawns, not killing their shade trees or offending them with vile odors; in fact, furnishing a perfect service is a problem of no mean proportions. Is there a manager among us who does not occasionally see the time when in his heart of hearts he wishes that he might wipe out the whole plant, works and mains, and put in its place one designed for the work of the present, to say nothing of the future? If our predecessors had only been as gifted with foresight as we with "hindsight," how much more comfortable would our positions be today? Sufficient main capacity for our distributing plant is an absolute necessity. It is worth something to be able to escape the numerous complaints of "poor gas," by having it so, as well as being due our customers, that they should have uniform pressure so that the conditions under which they burn gas are not continually changing. Nothing harrows up the soul of the average gas consumer so much as to have a moderate bill followed by one that has run "way out of sight." A systematic watch of all sections of our territory should be made. The pressure at stated points should be taken and recorded at regular seasons, and careful comparisons made to catch any lines of main that may be becoming overloaded. Money expended to preserve the integrity of the pressure is well spent.

With the sizes of mains well adjusted to the service required, the natural question arises, "What shall we use for pipe?" On the face of it, a seemingly foolish question; but there are always two sides to everything. Shall we use wrought iron, cast iron or steel? The question of unaccounted-for gas is a serious one, meriting our earnest attention. Of course, we all know that cast iron is almost universally used for mains; but, with its thousands of leaking joints and its liability to fracture, is it the best material we can use? A wrought iron main can be made absolutely tight, with 99 chances out of a 100 of its remaining so. Under only extraordinary conditions will it break, while it will sag and twist and bend from contraction and expansion with never a fracture. We are suspicious of it because of the belief that it will not last as long as cast iron; but we have no hesitation in putting in miles of wrought iron service, some with coating, some without. If the former, if thoroughly done, say with the mixture told of at the last American Association meeting, we believe they will last practically as long as cast iron. Why will not the mains? But, there is to the first cost to be considered. I have made a few figures, based upon last season's prices, with the following results. The 3-inch and 4-inch pipes cost practically the same, whether wrought or cast, for the smaller size the prices being 13 cents for wrought iron, and 13¼ cents for cast iron per foot; for 4 inch the prices being 18 cents and 17¾ cents respectively. In the case of 6 inch pipe they were 35.15 cents and 26.85 cents, the wrought costing 30 per cent., or 8.3 cents more, entail-

ing an extra expense of $438 + per mile of main laid. Eight-inch pipe would cost 13 cents more than cast iron, or $636 + more per mile of main laid, while 12-inch pipe would cost 69 cents more, or an added cost of $3,643 + per mile. In referring to the last Gas Commissioners' report at the time of this writing (that for the year ending June 30th, 1895), I find that the average loss of gas per mile of main in this State was 149,000 feet. Now, it would seem if that loss could be cut down to practically nothing, by using wrought iron mains, it would be worth while to use the sizes, up to and including the 8 inch, even with its increased cost of $686 per mile the saving would soon wipe out the difference. The larger sizes would perhaps be too expensive to consider, though a part of the extra expense would be balanced by the smaller labor account in the care of the mains after they were buried. A system of wrought iron mains, with leaded joints in the tees and crosses at the intersection of streets, with perhaps an expansion joint put in occasionally on a long run of main, would seem to be practicable and desirable. The same arguments that hold for wrought iron pipes would do for steel, and if the statement is true, that was made in the paper last October, on "Service Pipes and Service Piping,"[1] that steel will outlast iron, it of course stands to reason it is preferable; but one objection to it is its liability to be so hard as to be unworkable. It has been our experience that steel would not last as long as iron, where the conditions were such as to readily induce rusting. I will say that this advocacy of wrought mains is not entirely the result of theorizing, for our Company, some 20 years ago, laid about a mile of it, of which some four-fifths was 3 inch. In that distance for all this time we have found only one small leak; and last summer, when quite a section of it was uncovered by our friends the sewer builders, it was in every way in as good condition as cast iron would have been.

If cast iron must be used for mains the only controversy about it seems to be of what shall the joints be made? Cement and lead each have their advocates. The man that uses the former will say that the joints do not cost so much to make, in the first place, and they are reasonably sure to keep tight; and anyhow, if he has more breaks he would rather have one big leak to find than 100 small ones. The man that uses lead will say he can make as tight a joint with it as is possible with cement. In case of a possible leak it is more easily repaired, while the breakage from frost is reduced to minimum. In an experience of some 22 years with lead joints I have never seen a main broken by frost. When one reads in the daily papers of cases where a building is filled with gas from a broken main, some one dead, or a whole family overcome, he can but think cement joints a mistake; and when we consider that these breaks are more liable to come in cold weather with the surface of the ground frozen, which of necessity sends the gas into buildings, it would seem as if it were taking a grave responsibility to use cement for joints.

But the times change, and with them the conditions under which we work. With the use of electricity for propelling our street cars comes a new factor to be considered in determining what to use for mains and services.

While but few of us have had the misfortune to have our pipes destroyed by electrolysis, as have some of the companies in this vicinity, still the danger threatens wherever the useful "trolley" is in existence. Is there any pipe made, that is a non-conductor, which will still fulfil the requirements of a perfect gas main? In what I am about to say I hope no one will think I am trying to advertise any commodity, because I am not. I have no interest in the matter whatever, simply bringing it up, as, perhaps, being worthy of investigation, and in the hope that some one here may know all about it and will tell us. We have frequently received circulars advertising "fiber gas pipe." They read well, as do all advertisements; but in some respects the pipes have some features that recommend them. I have never had the nerve to lay any of them in a line of main, though strongly tempted to. That they are non-conductors and unaffected by electrical currents is probably true; that they can be made tight seems likely. They are put together with screw threads and couplings like wrought iron pipes, and have clamps to put around them wherever it is desirable to attach a service. Their expansion and contraction would probably be slight, tending to preserve the joints intact. Being rather elastic, they seemingly would not break readily in case of the ground under them settling. They are extremely light, so that the labor account in laying would be small, and the first cost is less than that of cast iron. They are poor heat conductors, a quality that would probably tend to lessen naphthaline troubles by keeping the gas at a more uniform temperature, thereby preventing those sudden changes that are so conducive to naphthaline deposits. On the whole, there are seemingly a number of good qualities about this kind of pipe to recommend a trial of it; but is it safe to use? Will it fulfil all the qualifications claimed for it? It cannot rust, but it will perhaps rot. It may not break, but it is seemingly possible for it to collapse, wholly or in part, thereby robbing it of its capacity. Who has used it, or who would dare give it a trial? Is it one of the new things that through our conservatism we are passing by and losing an ideal one?

The subject of cocks upon services and gates upon mains must necessarily come up in the consideration of our distributing plants. As to the former, their desirability or necessity seems to be a matter of individual or local choice. No rule of universal application can be laid down for their use. The conditions in no two places are entirely alike, and whether to use service cocks or not must be decided by each gas manager for himself. From the gas companies standpoint, though, it is doubtful, if, in eight places out of ten the country over, they are worth the time and bother they come to. If each company could figure out its chances or possibilities of loss from fire on each service pipe, these would be shown to be surprisingly small; but upon the question of gates thoroughly distributed over the whole of the system of mains, there would seem to be but one answer. Every section and individual line of pipe should have its gate or gates; if not for the company's sake for that of the consumers should it be so. They should be looked upon the same as a reserve fund, something to fall back upon in an emergency. More particularly is the need manifest in these days, when we have worked up a large fuel and power business. With constantly growing sewer systems, that too often must be built in the same line with the gas mains, with the growing practice of using heavy road rollers in our streets, and the increasing weights of our street cars, the safety of our gas pipes is constantly menaced. It is due our customers that we should be so situated, that we shall never have to shut the gas off from the whole town, or even off a large section at a time. It is worth something to us that we are dealing in a commodity that merits the title of "Old Reliable," in comparison with our prominent rival, and it would be poor policy to in any way damage that prestige.

There is one matter that, in the consideration of the distribution of gas, demands attention—our old enemy, naphthaline. I did not dare write a paper upon that subject, for fear of breaking up this meeting; but the purpose of bringing it up has been with me from the start. As one of the members wrote me, it is an old "chestnut." True, the moss is streaming from its head in constantly increasing length; but it is with us still. Like the "Old Man of the Sea," it haunts us ever. We have written about and discussed its cause and cure, without obviating the one or effecting the other. It seems to be an impossibility to manufacture an illuminating gas without creating naphthaline, and the whole question turns upon the means to keep it suspended in the gas and prevent its deposition in inconvenient places. It is not my purpose to discuss the various methods being tried for keeping it in the gas, nor of those for causing all that will deposit to do so where it can be handled conveniently; it may be that all those features will be brought out in the discussion. I merely wish to bring out a phase of the subject that has been brought to my attention in our experience.

I have been trying to construct a theory to fit our individual case; and, before springing it upon this Association, by writing around to a number of our members, I endeavored, through their experience, to either prove or disprove it, but with little success. One of the puzzles of naphthaline troubles is that, with apparently the same conditions attending the manufacturing part of the business, we are having more and more trouble upon the street. Every fall or late summer, when the heat begins to wane, the pest is in evidence; and with each term of years the calls of "poor light" are more frequent. Why? It has seemed to us that the disturbing cause must be outside the works, and the case is this: With our system of mains, as they radiate from our works, we could supply a certain amount of gas easily and with good pressure over all the lines. Before that normal amount of service had been exceeded we knew nothing of naphthaline; but with the growth of the city, new lines of main were added to those already laid, existing lines were largely extended, until the whole system was overtaxed, and the pressure over at least three-fourths of our territory was not up to what it should be. Ever since the trouble of stopped service pipes commenced it has grown from year to year, with seemingly no change in the manufacture to warrant it, and as it has kept pace with decreasing pressure it would seem as if they had some connection; while a central section of the city, bounded by a few streets, where the lowest pressures were experienced, was the center of our troubles. Wherever our pressure has remained normal we have had no trouble, and the number and frequency of the calls have seemed to be proportional to the decrease in pressures. Now, is it possible that the foregoing con-

1. See Am. Gas Light Journal, Dec. 7, 1896, p. 886.

ditions are a factor in the disturbance of the equilibrium of naphthaline? Not being an integral part of gas, but being held in suspension very delicately, and apparently seeking the least cause for breaking off its relation with it, does not the increased rush and swirl of the gas through the main that is too small furnish the cause for the throwing down and collection into the crystals we know so well, so that when the gas gets to where the current is slower, as in the services, they are readily deposited? I am unable to prove or disprove the question. Out of the 19 replies to my questions, only five had found that their naphthaline trouble had been more frequent where the mains were small enough to affect the pressure, while the others had never noticed anything of the kind. One member believed the pressure had nothing to do with it; but as he was happily able to say that he had never had any naphthaline troubles, I do not know that he was competent to express an opinion. It would seem that there is some connection between an excessive draught upon a main with an abnormal loss of pressure and the formation of the crystals, and that the trouble may be lessened by increasing the size of the pipe, so the gas may be delivered easily with no rapid current and with normal pressure.

*Discussion.*

The President—This is a question on which there ought to be plenty of discussion. In the first place, you have wrought iron, cast iron and composition pipe, and you have lead and cement joints—all subjects which ought to evoke discussion; and we shall be very glad to hear from any member.

Mr. Gifford—I had hoped someone would say something about fiber pipe, for I was consulted as an expert the other day as to it, and very safely got out of it by saying I knew nothing about it; that I had heard of it but never had seen it. As to the question of naphthaline in small pipes, I suppose many of us have seen cases where naphthaline was deposited when the gas was going through a smaller pipe, at the stopcock, etc. Possibly that may occur owing to the well-known fact that crystallization often takes place with a little jar. For instance, possibly you have seen water all ready to crystallize into ice, and on a slight jar it would immediately freeze all through. Possibly that may be the explanation. I think anything that I could say about naphthaline should be preceded by "possibly."

Mr. McKay—As to wrought iron pipe, I will say we have one main that was laid ten years ago. It doesn't carry gas, but the life of the exterior of a pipe is not affected by its contents. That main, which is over a mile in length, was examined in its tenth year and found in perfect condition, except three lengths which lay in a very wet marsh. This pipe was laid in a very exposed location, and expansion joints were placed along the line, I think, about every 500 feet. The pipe is now so tight that we can, with a pump on it, raise a vacuum of about 20 inches, that will remain at 20 inches for a number of hours—which is a pretty good record for ten years' work. About the valves that are used in distribution, I would like to know what kind of valve Mr. Snow recommends the use of; whether a valve which might be affected with heat and made to leak in case of emergency such as fire, or one that is all iron, or any others?

The President—Does any gentleman present know anything about fiber pipe as to its durability, or who has had any experience with it?

Capt. White—Mr. President, I venture to take up your time for a minute, as I have had some experience with this fiber pipe. It is vicarious largely. Practising that cowardice which we in our business misname conservatism, when it was possible for me to lay some of this pipe, after very careful consideration I did not do so; but I know of three miles of it now in its third year of use. Part of it is conveying gas from the scrubbers of a water gas apparatus through the works, possibly as severe a test such pipe could be given, for it is carrying the unpurified gas after passing the scrubber. It has given entire satisfaction. This pipe I have seen exposed, as dug up at different points, and it was apparently without any injury from the surrounding earth. So far as I can discover by examination, after tapping the pipe, there has been no wearing or eating of the surface by the passing of gas or the flow of condensed matter. I had an opportunity, however, in another direction, to lay some 3,000 feet of 10-inch fiber pipe (I presume it is the same pipe, from Orangeburg, N.Y.), for the purpose of carrying water from a dam, over land, where it was very rocky; and it would have been a very expensive piece of work to dig a trench to bury this pipe. It was in Vermont, where you know the winters are long and the summers correspondingly short. I recommended the use of this fiber pipe in this instance; and it has been running now about a year. I have in my possession, at my office, a report from the gentleman to whom I suggested the laying of this pipe, stating that an examination, made in the month of November last, showed that the pipe was absolutely as good as ever on the inside and outside, though it had been exposed in the winter and during the summer to the elements, such as they might be, and to the snow and everything else, and that it had received no injury at all. But I was scared out of using it. I wanted to extend some mains into one of my towns, and I concluded at first that I would use this pipe, as it was a little cheaper than cast iron pipe; when actually in the trench and covered there is a slight difference in the actual cost. But before deciding I took a section of this pipe, possibly about a foot long and 3 inch diameter, and had liquor from my holder-drip put into a bucket, and put this pipe into the liquor and let it stand—it was coal gas liquor, and it was a very severe test to give this pipe—fibrous pipe is made of paper treated with bitumen. I left it in there for about a week and then examined it, having given it no attention in the meantime, I found that it was practically all disintegrated, the wrapping had all separated, and the part that was placed in the liquor had frayed out and looked like a sponge. Of course, as I say, I permitted my conservatism then to come to my aid. But to what extent any pipe of that character laid in the present distribution system would be subjected to so severe a test as that, you can judge as well as myself. I think it was unfair to the pipe, and I am equally frank in saying that I think I was a bit cowardly in not laying this pipe. Before I take my seat, I would like to say on the subject of wrought iron or steel pipe as compared with the cast iron, we have had an excellent opportunity in the city of New York to judge somewhat of the durability of the wrought iron article. The Standard Gas Company laid nearly all its main system, in the upper part of New York City, of wrought iron, and it has been there some ten years or more. They meet probably all the varieties of soil that any gas company would find in its actual experience; and it is the experience of that Company, and it is my personal experience, in seeing trenches opened for the purpose of laying services or making additional connections of one kind and another, that I never yet have seen a piece of that pipe that was not just as good in its appearance as the adjoining cast iron pipe of the old companies. I have seen no apparent injury to that kind of pipe in any of these openings. I think we have no reason to expect that wrought pipe will not be as serviceable, and last as long as cast iron pipe, if properly laid.

Mr. Fowler—I should like to ask Captain White how the joints are made in the wrought iron pipe; that is, suppose they are put together with screw crosses or with elbows, as the ordinary wrought iron pipe is put together, in case of any accident in the putting in of those fittings, how are they put into good order again? We find that extremely difficult to manage in our underground wrought iron plants; and in putting in an elbow which lay next to a T, the men on the job have made various mistakes. They have to get everything just right to bring it together, and it is a long job. I remember one particular occasion when the hole must have been open three or four days for the men to be able to get everything done with perfect accuracy; and I should like to know how that is fixed?

Captain White—I think the practice of the Standard Company in New York have is to put in the Globe fitting—a little cast iron fitting made in Providence. It is put in the wrought pipe about the same as you do with your cast iron pipe—make the screwing at the intersection of every expansion joint. Of course you increase the chance of leakage to a slight extent, but you get expansion, and you get an opportunity to make different connections. In the first place we put in regular screw crosses and T's as we went along. These old-fashioned expansion joints have been abandoned now; in fact, the Standard Company has taken out quite a number of them and replaced them with small globe castings. That gives an opportunity, as I said, for expansion, and overcomes the loss of time and labor in making these extremely close fittings. I believe that is the rule now pretty much all over the country where they are using either steel or wrought iron. I would like to say my experience runs parallel with that of the writer of this paper. Wrought iron pipe is better than steel pipe. It will stand its work better, and will stand varieties of soil to better advantage than the mild steel pipe; the mild drawn pipe is like a good many mild mannered men. It turns out pretty hard after you get at it sometimes, and it is impossible to do anything with it.

Mr. Snow—In answer to Mr. McKay's question about the steel we use, the conditions with us are probably different from what they are with him, so that I could not tell how it would be in his case.

Mr. Sherman—Mr. President, a gentleman is present with us who has had ten years' experience, more or less, with wrought iron mains, and I would like to hear from him. I refer to Mr. Lane, of Wallingford.

Mr. Lane—Mr. Sherman is mistaken. Our mains are of steel, and so far we have had no trouble; they are working very well.

The President—What kind of joints?

Mr. Lane—Lead joints, ball and spigot, coated heavily on the inside and out with some preparation which protects it from the action of the gas.

The Secretary—It seems to be almost demonstrated now that electrolysis does not have near the effect on cast iron pipe that it does on wrought iron pipe. The report of the Board of Subway Commissioners, of Brooklyn, N.Y., who were experimenting on this matter, definitely stated that cast iron pipe is very much less acted upon by electrolysis than wrought iron. If that is a fact, it is going to have considerable bearing on this matter.

The President—Are there any other gentlemen who would like to discuss this question of pipes and joints?

Mr. Woodward—Mr. President, I have personally advocated cement joints, and have used them for a number of years, and always with good success. I prefer to have a large leak in the main—and they do not usually break at the joints—rather than a number of small leaks at the lead joints. An instance was brought to my attention last summer concerning about 20 miles of main; and the engineers who laid out the plan of this large work were advocates of cement joints. They proposed to lay this large amount of work, and a part of the plan was to give it a thorough testing. The mains were to be laid, and small sections were to be tested at 2 pounds pressure. Starting in, they thought they knew how to make cement joints; but in testing them they could not get any of those joints to stand 2 pounds pressure. Fearing that they were not perhaps competent for the making of cement joints, they called in other experts from all over the country. Everybody gave them a little advice, but, as a matter of fact, they gave up that whole system of the making of cement joints, because they couldn't get them tight to stand 2 pounds pressure. It was a surprising thing to me. I never had any trouble, but yet I never tested with pressure. I think it is common among engineers who lay cement joints, if they don't have any gas leaks, to take it for granted they are going to be tight; but I would like to find out from members here if they have had experience in testing mains under pressure, laid with cement joints, and if they stood. I have been particularly interested in Mr. Snow's paper, and in the point that he raises regarding weak spots in his system. That has been brought to our notice, and some time ago I adopted a plan of periodically at night, when the consumption was heaviest, going over the system and making tests at lamp posts, all over the system, and making a chart to show the pressure at these points at that certain time. It has been extremely valuable. Once I was supplying gas in a section of the town where I could not imagine, from the size of the pipes, we would have any trouble, but the weak place was shown very graphically by this chart that I made of the pressures taken at lamp posts, and it was necessary for us to immediately lay some large pipes there, which we did not expect to have to do for years. I would certainly recommend to the members to make a systematic test of street pressure, and keep records of tests at lamp posts, or wherever you are a mind to make them. Another thing in connection with this: In weak places I often times take a Fowler recording pressure gauge and put it in a man's cellar, to give me a chart of how the pressure varies on that line from time to time, and we keep that chart and often refer to it. As far as wrought iron mains go, I have never used any outside; but our whole works have been laid throughout with wrought iron connections, and they have given me a great amount of satisfaction. The ease of taking it apart and putting it together again, if you want to make any change, is a great benefit. I have done a good deal of changing over our works lately, putting in new apparatus and rebuilding, and I have found, in making a temporary connection, you can make it very much easier with wrought iron pipe and flange or screw joint connections than you can with cast iron pipe with bell and spigot joints. Our purifiers are also something you do not often see. They are all of wrought iron, and all connected up with wrought iron pipe.

The President—To my mind comes the fact of a line of pipe which we laid in Boston at one time, from Gerard street Station to Commercial Point—30-inch pipe, some 3½ or 4 miles in length. When that pipe was tested it was closed at both ends and pressure put on it. This pressure remained several days, which shows very good work indeed. This pipe was laid with all cement joints.

On motion of Mr. Gifford a vote of thanks was passed to Mr. Snow for his very interesting paper.

The President then called for the

REPORT FROM THE COMMITTEE ON NAPHTHALINE,

which was read by Mr. F. C. Sherman, as follows:

The Committee to whom was referred the matter of deposit of naphthaline in mains and services would make the following report: The effect of refrigeration in causing a deposit of naphthaline was tried on a working scale, at the works of the New Haven Gas Company, during the past season. A multitubular condenser, of capacity sufficient to care for all the gas being made, was put in position to take the gas as it came from the purifiers. The gas entered the purifiers at 60° F., and issued from them at 70° F. The multitubular condenser reduced this down to 60° F. The connections from the purifiers to the station meter and holders are 20 inch, and up to this last year have had large deposits of naphthaline in them, which had to be removed every year. It was hoped and expected that, by placing a condenser immediately after the purifiers, the naphthaline would be deposited in this condenser. In this we were disappointed. Strange to say, there was no deposit in the condenser or the connections to station meter and holders. The naphthaline passed forward to our mains, services, meters and consumers' fixtures. We were never more annoyed with it than during the last autumn.

We reduced the formation of naphthaline by lowering the heats in our generator. About the first of August we changed from gas oil to naphtha; running at same heats in generator with naphtha as we did with gas oil formed large quantities of naphthaline. We got some relief by this change. Later in the season I heard of several works that had been relieved from this great annoyance by introducing naphtha into the gas at the holder outlet. I determined to try it, and utilized a disused fuel water heater for the purpose of vaporizing the naphtha. I introduced the vapors in the outlet of the holders after the gas had passed the street governor. I turned on the vapors at lighting up time and put in 150 gallons in two hours. In our case it was a great success, reducing the complaints from this source to the normal condition of, say, a dozen a day instead of 150, as it had been. Our sendout at this time was 150,000 feet per hour. We shall try naphtha vapors another year, when the naphthaline days come around, and if it works as well as it did this last season we shall consider the naphthaline question and crystals solved.

The report was accepted, and the Association adjourned to reassemble at 2:30 P.M.

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FIRST DAY—AFTERNOON SESSION.

The President called the convention to order at 3 o'clock, and introduced Mr. W. E. McKay, of Boston, Mass., who read the following paper on

## TEMPERATURE.

Not long ago in an argument with a gas engineer respecting the effect of temperature upon gas, I was asked, "What does 'King' say upon the subject?" This question is so frequently used as a reference to a court of last resort, that it seems worth answering. Twenty years ago, "King's Treatise" says, "The thermometer should be employed in every gas works, and attached to both the inlet and outlet of the condenser, so that a record of the temperature of the gas may always be kept;" and the whole subject of condensation is compressed within two pages.

Each succeeding year has brought forward new witnesses to testify to the importance of thermometric observations. In 1890, A. E. Forestall before the American Gas Light Association, writes: "A record should be kept of the average daily temperatures along the whole line of the condensing plant. Condensation is perfect only when the gas leaves the apparatus containing just enough hydrocarbon vapor to fully saturate it at the minimum of temperature and the maximum of pressure to which it is to be subjected in the future. Thermometers with the condensers are absolutely necessary. Combined efforts along both lines, distillation and condensation, may change the present ideas as to the illuminating value of a gallon of oil."[1] In 1888, D. H. Geggie, before the American Gas Light Association, treats of "Distribution under Extremely Low Temperatures."[2] In 1892, John M. Rusby, before the American Gas Light Association, writes on "Water Gas Condensation,"[3] setting forth the importance of temperature.

In 1893 James Somerville writes on "The Relation of Temperature to Purification."[4]

In 1894 George H. Harper, in an excellent paper on "Applications

1. See JOURNAL, Nov. 10, 1890, p. 655.
2. See JOURNAL, Nov. 2, 1888, p. 814.
3. See JOURNAL, Nov. 21, 1892, p. 729.
4. See JOURNAL, Nov. 6, 1893, p. 655.

*Table for Carbureted Water Gas Saturated with Aqueous Vapor, no other Vapors being Present—Showing, with Change of Temperature, the Change in Volume of Unit Weight of Gas and the Change in Weight of Unit Volume of the Mixture of Gas and Aqueous Vapor.*

| I. | II. | III. | IV. | V. | VI. | VII. | I. | II. | III. | IV. | V. | VI. | VII. | I. | II. | III. | IV. | V. | VI. | VII. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp. F°. | Vapor Tension. | Gas Pressure =30″—II. | Volume of Unit Weight of Gas (51 pounds). | Weight of Volume (Col. IV.) of Aqueous Vapor in Lbs. | Weight of Gas and Vapor m V + 51.00. | Weight of 1,000 cu. ft. Gas and Vapor at Temp. I. and Pressures II. and III. | Temp. F°. | Vapor Tension. | Gas Pressure =30″—II. | Volume of Unit Weight of Gas (51 pounds). | Weight of Volume (Col. IV.) of Aqueous Vapor in Lbs. | Weight of Gas and Vapor m V + 51.00. | Weight of 1,000 cu. ft. Gas and Vapor at Temp. I. and Pressures II. and III. | Temp. F°. | Vapor Tension. | Gas Pressure =30″—II. | Volume of Unit Weight of Gas (51 pounds). | Weight of Volume (Col. IV.) of Aqueous Vapor in Lbs. | Weight of Gas and Vapor m V + 51.00. | Weight of 1,000 cu. ft. Gas and Vapor at Temp. I. and Pressures II. and III. |
| 200 | 23.435 | 6.565 | 5700 | 167.24 | 218.24 | 38.29 | 143 | 6.322 | 23.678 | 1444 | 12.51 | 63.51 | 43.98 | 86 | 1.241 | 28.759 | 1076 | 2.02 | 53.02 | 49.26 |
| 199 | 22.953 | 7.047 | 5302 | 152.60 | 203.60 | 38.41 | 142 | 6.162 | 23.838 | 1432 | 12.11 | 63.11 | 44.08 | 85 | 1.202 | 28.798 | 1073 | 1.96 | 52.96 | 49.36 |
| 198 | 22.480 | 7.520 | 4961 | 140.05 | 191.05 | 38.51 | 141 | 6.006 | 23.994 | 1420 | 11.73 | 62.73 | 44.17 | 84 | 1.164 | 28.836 | 1069 | 1.89 | 52.89 | 49.46 |
| 197 | 22.016 | 7.984 | 4666 | 129.19 | 180.19 | 38.63 | 140 | 5.844 | 24.146 | 1409 | 11.36 | 62.36 | 44.26 | 83 | 1.127 | 28.873 | 1066 | 1.83 | 52.83 | 49.55 |
| 196 | 21.559 | 8.441 | 4406 | 119.67 | 170.67 | 38.73 | 139 | 5.704 | 24.296 | 1398 | 11.00 | 62.00 | 44.35 | 82 | 1.092 | 28.908 | 1063 | 1.77 | 52.77 | 49.65 |
| 195 | 21.110 | 8.890 | 4177 | 111.25 | 162.25 | 38.84 | 138 | 5.558 | 24.442 | 1387 | 10.65 | 61.65 | 44.44 | 81 | 1.057 | 28.943 | 1060 | 1.71 | 52.71 | 49.74 |
| 194 | 20.669 | 9.331 | 3974 | 103.75 | 154.75 | 38.94 | 137 | 5.415 | 24.585 | 1377 | 10.32 | 61.32 | 44.53 | 80 | 1.023 | 28.977 | 1056 | 1.65 | 52.65 | 49 84 |
| 193 | 20.236 | 9.764 | 3792 | 97.10 | 148.10 | 39.06 | 136 | 5.275 | 24.725 | 1367 | 10.00 | 61.00 | 44.63 | 79 | .990 | 29.010 | 1053 | 1.60 | 52.60 | 49.93 |
| 192 | 19.810 | 10.190 | 3628 | 91.08 | 142.08 | 39.16 | 135 | 5.139 | 24.861 | 1357 | 9.68 | 60.68 | 44.72 | 78 | .958 | 29.042 | 1050 | 1.54 | 52.54 | 50.03 |
| 191 | 19.392 | 10.608 | 3479 | 85.64 | 136.64 | 39.27 | 134 | 5.005 | 24.995 | 1347 | 9.38 | 60.38 | 44.81 | 77 | .927 | 29.073 | 1047 | 1.49 | 52.49 | 50.12 |
| 190 | 18.981 | 11.019 | 3344 | 80.70 | 131.70 | 39.38 | 133 | 4.874 | 25.126 | 1338 | 9.09 | 60.09 | 44.91 | 76 | .896 | 29.104 | 1044 | 1.44 | 52.44 | 50.22 |
| 189 | 18.577 | 11.423 | 3221 | 76.19 | 127.19 | 39.49 | 132 | 4.747 | 25.253 | 1329 | 8.81 | 59.81 | 45.00 | 75 | .867 | 29.133 | 1041 | 1.39 | 52.39 | 50.32 |
| 188 | 18.181 | 11.819 | 3109 | 72.07 | 123.07 | 39.59 | 131 | 4.622 | 25.378 | 1320 | 8.53 | 59.53 | 45.09 | 74 | .839 | 29.161 | 1038 | 1.34 | 52.34 | 50.42 |
| 187 | 17.792 | 12.208 | 3005 | 68.28 | 119.28 | 39.70 | 130 | 4.500 | 25.500 | 1312 | 8.27 | 59.27 | 45.18 | 73 | .811 | 29.189 | 1035 | 1.30 | 52.30 | 50.52 |
| 186 | 17.410 | 12.590 | 2909 | 64.78 | 115.78 | 39.80 | 129 | 4.381 | 25.619 | 1304 | 8.01 | 59.01 | 45.27 | 72 | .784 | 29.216 | 1032 | 1.25 | 52.25 | 50.62 |
| 185 | 17.034 | 12.966 | 2820 | 61.55 | 112.55 | 39.91 | 128 | 4.264 | 25.736 | 1295 | 7.76 | 58.76 | 45.36 | 71 | .758 | 29.242 | 1030 | 1.21 | 52.21 | 50.71 |
| 184 | 16.666 | 13.334 | 2737 | 58.58 | 109.58 | 40.01 | 127 | 4.150 | 25.850 | 1287 | 7.52 | 58.52 | 45.45 | 70 | .733 | 29.267 | 1027 | 1.17 | 52.17 | 50.81 |
| 183 | 16.304 | 13.696 | 2663 | 55.77 | 106.77 | 40.11 | 126 | 4.039 | 25.961 | 1280 | 7.29 | 58.29 | 45.55 | 69 | .708 | 29.292 | 1024 | 1.13 | 52.13 | 50.91 |
| 182 | 15.949 | 14.051 | 2591 | 53.18 | 104.18 | 40.22 | 125 | 3.930 | 26.070 | 1272 | 7.06 | 58.06 | 45.64 | 68 | .684 | 29.316 | 1021 | 1.09 | 52.09 | 51.02 |
| 181 | 15.600 | 14.400 | 2524 | 50.75 | 101.75 | 40.32 | 124 | 3.824 | 26.176 | 1265 | 6.84 | 57.84 | 45.73 | 67 | .661 | 29.339 | 1018 | 1.06 | 52.06 | 51.12 |
| 180 | 15.258 | 14.742 | 2461 | 48.49 | 99.49 | 40.42 | 123 | 3.720 | 26.280 | 1258 | 6.63 | 57.63 | 45.82 | 66 | .639 | 29.361 | 1015 | 1.02 | 52.02 | 51.22 |
| 179 | 14.922 | 15.078 | 2403 | 46.37 | 97.37 | 40.53 | 122 | 3.619 | 26.381 | 1251 | 6.43 | 57.43 | 45.91 | 65 | .617 | 29.383 | 1013 | .98 | 51.98 | 51.32 |
| 178 | 14.592 | 15.408 | 2348 | 44.37 | 95.37 | 40.63 | 121 | 3.520 | 26.480 | 1244 | 6.23 | 57.23 | 46.00 | 64 | .596 | 29.404 | 1010 | .95 | 51.95 | 51.42 |
| 177 | 14.268 | 15.732 | 2296 | 42.49 | 93.49 | 40.73 | 120 | 3.423 | 26.577 | 1237 | 6.03 | 57.03 | 46.09 | 63 | .576 | 29.424 | 1008 | .92 | 51.92 | 51.52 |
| 176 | 13.951 | 16.049 | 2247 | 40.73 | 91.73 | 40.83 | 119 | 3.329 | 26.671 | 1231 | 5.85 | 56.85 | 46.19 | 62 | .556 | 29.444 | 1005 | .88 | 51.88 | 51.62 |
| 175 | 13.639 | 16.361 | 2201 | 39.05 | 90.05 | 40.92 | 118 | 3.237 | 26.763 | 1224 | 5.67 | 56.67 | 46.28 | 61 | .536 | 29.464 | 1003 | .85 | 51.85 | 51.72 |
| 174 | 13.333 | 16.667 | 2157 | 37.46 | 88.46 | 41.06 | 117 | 3.147 | 26.853 | 1218 | 5.49 | 56.49 | 46.37 | 60 | .518 | 29.482 | 1000 | .82 | 51.82 | 51.82 |
| 173 | 13.033 | 16.967 | 2115 | 35 99 | 86.99 | 41.13 | 116 | 3.059 | 26.941 | 1212 | 5.32 | 56.32 | 46.46 | 59 | .500 | 29.500 | 998 | .79 | 51.79 | 51.92 |
| 172 | 12.739 | 17.261 | 2076 | 34.58 | 85.58 | 41.23 | 115 | 2.974 | 27.026 | 1206 | 5.15 | 56.15 | 46.55 | 58 | .482 | 29.518 | 995 | .76 | 51.76 | 52.02 |
| 171 | 12.450 | 17.550 | 2039 | 33.23 | 84.23 | 41.33 | 114 | 2.890 | 27.110 | 1200 | 4.99 | 55.99 | 46.64 | 57 | .465 | 29.535 | 992 | .74 | 51.74 | 52.13 |
| 170 | 12.167 | 17.833 | 2003 | 31.96 | 82.96 | 41.42 | 113 | 2.809 | 27.191 | 1195 | 4.84 | 55.84 | 46.74 | 56 | .449 | 29.551 | 990 | .71 | 51.71 | 52.23 |
| 169 | 11.889 | 18.111 | 1969 | 30.75 | 81.75 | 41.53 | 112 | 2.729 | 27.271 | 1189 | 4.69 | 55.69 | 46 83 | 55 | .433 | 29 567 | 988 | .68 | 51.68 | 52.33 |
| 168 | 11.617 | 18.383 | 1937 | 29.60 | 80 60 | 41.61 | 111 | 2.652 | 27.348 | 1184 | 4.54 | 55.54 | 46.92 | 54 | .418 | 29.582 | 985 | .66 | 51.66 | 52.44 |
| 167 | 11.350 | 18.650 | 1906 | 28.51 | 79.51 | 41.71 | 110 | 2.576 | 27.424 | 1178 | 4.40 | 55.40 | 47.01 | 53 | .403 | 29.597 | 983 | .64 | 51.64 | 52.55 |
| 166 | 11.088 | 18.912 | 1877 | 27.47 | 78.47 | 41.81 | 109 | 2.502 | 27.498 | 1173 | 4.26 | 55.26 | 47.10 | 52 | .388 | 29.612 | 980 | .61 | 51.61 | 52.65 |
| 165 | 10.831 | 19.169 | 1849 | 26.47 | 77.47 | 41.91 | 108 | 2.430 | 27.570 | 1168 | 4.13 | 55.13 | 47.20 | 51 | .374 | 29.626 | 978 | .59 | 51.59 | 52.75 |
| 164 | 10.579 | 19.421 | 1822 | 25.52 | 76.52 | 42.01 | 107 | 2.360 | 27.640 | 1163 | 4.00 | 55.00 | 47.29 | 50 | .361 | 29.639 | 975 | .57 | 51.57 | 52.86 |
| 163 | 10.332 | 19.668 | 1796 | 24.61 | 75.61 | 42.10 | 106 | 2.292 | 27.708 | 1158 | 3.87 | 54.87 | 47.38 | 49 | .348 | 29.652 | 973 | .55 | 51.55 | 52.97 |
| 162 | 10.090 | 19.910 | 1771 | 23.74 | 74.74 | 42.20 | 105 | 2.225 | 27.775 | 1153 | 3.75 | 54.75 | 47.47 | 48 | .335 | 29.665 | 971 | .53 | 51.53 | 53.08 |
| 161 | 9.853 | 20.147 | 1748 | 22.91 | 73.91 | 42.29 | 104 | 2.160 | 27.840 | 1148 | 3.63 | 54.63 | 47.57 | 47 | .323 | 29.677 | 969 | .51 | 51.51 | 53.18 |
| 160 | 9.621 | 20.379 | 1725 | 22.12 | 73.12 | 42.39 | 103 | 2.097 | 27.903 | 1144 | 3.52 | 54.52 | 47.66 | 46 | .311 | 29.689 | 966 | .49 | 51.49 | 53.28 |
| 159 | 9.393 | 20.607 | 1703 | 21.35 | 72.35 | 42.48 | 102 | 2.035 | 27.965 | 1139 | 3.41 | 54.41 | 47.75 | 45 | .299 | 29.701 | 964 | .47 | 51.47 | 53.39 |
| 158 | 9.170 | 20.830 | 1682 | 20.63 | 71.63 | 42.58 | 101 | 1.975 | 28.025 | 1135 | 3.30 | 54.30 | 47.84 | 44 | .288 | 29.712 | 962 | .45 | 51.45 | 53.50 |
| 157 | 8.951 | 21.049 | 1662 | 19.92 | 70.92 | 42.67 | 100 | 1.917 | 28.083 | 1130 | 3.20 | 54.20 | 47.94 | 43 | .278 | 29.722 | 960 | .44 | 51.44 | 53.61 |
| 156 | 8.737 | 21.263 | 1643 | 19.25 | 70.25 | 42.77 | 99 | 1.860 | 28.140 | 1126 | 3.10 | 54.10 | 48.03 | 42 | .267 | 29.733 | 958 | .42 | 51.42 | 53.72 |
| 155 | 8.527 | 21.473 | 1624 | 18.60 | 69.60 | 42.86 | 98 | 1.804 | 28.196 | 1122 | 3.00 | 54.00 | 48.13 | 41 | .257 | 29.743 | 955 | .40 | 51.40 | 53.82 |
| 154 | 8.321 | 21.679 | 1606 | 17.98 | 68.98 | 42.96 | 97 | 1.750 | 28.250 | 1118 | 2.90 | 53.90 | 48.22 | 40 | .248 | 29.752 | 953 | .38 | 51.38 | 53.93 |
| 153 | 8.120 | 21.880 | 1588 | 17.39 | 68.39 | 43.06 | 96 | 1.697 | 28.303 | 1114 | 2.81 | 53.81 | 48.32 | 29 | .238 | 29.762 | 951 | .37 | 51.37 | 54.04 |
| 152 | 7.922 | 22.078 | 1572 | 16.81 | 67.81 | 43.15 | 95 | 1.646 | 28.354 | 1110 | 2.72 | 53.72 | 48 41 | 38 | .229 | 29.771 | 949 | .36 | 51.36 | 54.16 |
| 151 | 7.729 | 22.271 | 1556 | 16.26 | 67.26 | 43.24 | 94 | 1.596 | 28.404 | 1106 | 2.63 | 53.63 | 48.51 | 37 | .220 | 29.780 | 946 | .35 | 51.35 | 54.27 |
| 150 | 7.540 | 22.460 | 1540 | 15.73 | 66.73 | 43.34 | 93 | 1.547 | 28.453 | 1102 | 2.55 | 53.55 | 48.60 | 36 | .212 | 29.788 | 944 | .34 | 51.34 | 54.38 |
| 149 | 7.354 | 22.646 | 1525 | 15.21 | 66.21 | 43.43 | 92 | 1.500 | 28.500 | 1098 | 2.47 | 53.47 | 48.70 | 35 | .204 | 29.796 | 942 | .33 | 51.32 | 54.49 |
| 148 | 7.173 | 22.827 | 1510 | 14.72 | 65.72 | 43.52 | 91 | 1.454 | 28.546 | 1094 | 2.39 | 53.39 | 48.79 | 34 | .196 | 29.804 | 940 | .31 | 51.31 | 54.60 |
| 147 | 6.996 | 23.004 | 1496 | 14.25 | 65.25 | 43.62 | 90 | 1.409 | 28.591 | 1090 | 2.31 | 53.31 | 48.88 | 33 | .188 | 29.812 | 938 | .30 | 51.30 | 54.71 |
| 146 | 6.822 | 23.178 | 1482 | 13.79 | 64.79 | 43.71 | 89 | 1.365 | 28.635 | 1087 | 2.23 | 53.23 | 48.97 | 32 | .181 | 29.819 | 936 | .28 | 51.28 | 54.82 |
| 145 | 6.651 | 23.349 | 1469 | 13.35 | 64.35 | 43.80 | 88 | 1.323 | 28.677 | 1083 | 2.16 | 53.16 | 49.07 | 31 | .173 | 29.827 | 933 | .27 | 51.27 | 54.93 |
| 144 | 6.485 | 23.515 | 1457 | 12.92 | 63.92 | 43.89 | 87 | 1.282 | 28.718 | 1080 | 2.09 | 53.09 | 49.16 | 30 | .166 | 29.834 | 931 | .26 | 51.26 | 55.05 |

Barometric variations of pressure exceed the usual variations of pressure at different points in a gas-works, and the mixture of gas and vapor has been considered as under the normal pressure of 30″ mercury.

Column I. gives the temperature in degrees Fahrenheit.

Column II. gives the tension of saturated aqueous vapor in inches of mercury, corresponding to the temperature in I. This vapor tension is from Dixon's tables for latitude 53°.

Column III. gives the pressure under which the gas is contained; this pressure is 30″ — the vapor tension in column II.

Column IV. gives the volume of unit weight of gas, at the temperature and pressure given in columns I. and III. Unit weight of gas (51 pounds) is the weight of the gas in the mixture of 1,000 cubic feet of gas and vapor at 60° F. Unit volume is 1,000 cubic feet.

Column V. gives the weight of aqueous vapor corresponding to the pressure in column II. and to the volume in column IV.; this weight is the aqueous vapor carried by unit weight of gas at the temperature given in column I.

Column VI., the weight of gas and vapor, is 51 lbs. + column V.

Column VII. gives the weight of the mixture of gas and vapor occupying 1,000 cubic feet at the temperature and pressures stated.

of Chemical Technology to Gas Manufacture,"[1] says: "Condensation offers a rich and wide field for cultivation by means of systematic analysis, and the intelligent and persistent use of thermometers. The data thus collected would be invaluable. In scrubbing and washing, temperature plays an important part."

In 1896 Alten S. Miller, in a paper on "The Separation of Water Gas Tar,"[2] describes the solution of this difficulty by determining 160° F. as the temperature at which, with a slow flow, separation of the tar can be effected."

Messrs. Taber, Jones, Greenough, Benson and others have almost yearly, before this Association and elsewhere, confirmed the value of knowledge of temperature, whether at the retorts or in the mains, or at any point of the process of manufacture.

Last year, at the New England meeting, N. W. Gifford made an interesting presentation[3] of the subject in relation to consumers' meters. The subject of temperature was also revived on the question of "naphthaline;"[4] and, indeed, these two subjects have been inseparable from the beginning of gas manufacture.

1. See JOURNAL, Nov. 12, 1894, p. 692.
2. See JOURNAL, Nov. 30, 1896, p. 847.
3. See JOURNAL, March 16, 1896, p. 407.
4. See JOURNAL, March 23, 1896, p. 450.

Thus at every stage—manufacture, condensation, purification, distribution—it is conceded that temperature is an important item that may be made to contribute to the economy of manufacture, and to the excellence of the product.

Illuminating gas may be tested for its impurities, or for its composition, by an analysis; or for its weight or for its value, by photometry, or by calorimetry. All of these tests require time, are always desirable, and occasionally necessary; but a simple reading of the temperature of the gas at any point in its making gives a statement of its condition which is reliable and valuable. This statement is with respect to the aqueous vapor in the gas. As to the hydrocarbon vapors, they are relatively small in amount, they are variable in character, and their vapor-tensions are not definitely known and cannot easily be determined; but with aqueous vapor it is different, for the amounts carried by the gas are, at high temperatures, enormous, the variations follow a known law, and the factors of temperature and pressure have been established with extreme accuracy.

Dalton's laws are: 1. The tension, and consequently, the quantity of vapor which saturates a given space, is the same for the same temperature, whether this space contains a gas or is a vacuum. 2. The tension of a mixture of a gas and a vapor is equal to the sum of the tensions which each would possess if it occupied the same space alone.

Regnault further showed that, "when two liquids exert no solvent action on each other, the tension of the vapor which rises from them is nearly equal to the sum of the tensions of the two separate liquids at the same temperature." There is a fourth law, as to the tension in two communicating vessels at different temperatures, which modifies the others.

Neglecting the vapors of tar, of tar oils, and of drip liquors, I have computed the theoretical elements of a table to show the effect of the presence of aqueous vapor in the gas at different temperatures. This table has been supplemented by experiment and observation, and a fair agreement has been found between theory and practice at the temperatures used. The presence of hydrocarbon vapors modifies the actual condition of the gas, the relative amounts of these vapors greatly increasing as the temperature falls. Thus the table is inexact, because the assumptions upon which the computations are based are inexact.

Aqueous vapor claims consideration in the design as well as in the operation of a gas works. If the gases leaving the hydraulic main, or washbox, are not saturated with aqueous vapor, no deposition of water will take place until the vapor tension in the mixture corresponds to saturation at the temperature of the point of deposition. It is, therefore, desirable to know at what point in the apparatus, and at what temperature, the gas is saturated. It is difficult to determine this exactly. I have found the gas saturated with aqueous vapor at 183° F., and I think that the limit is somewhat higher than this for water gas.

When the temperature of the gas falls there will be a deposition of water corresponding to the table, unless the gas flows so fast that drops of water are entrained by the current, and mechanically conveyed by the gas. Where this happens the gas may be described as super-saturated with aqueous vapor.

It is seen that at the high temperatures the variations in volume of the gas and vapor are rapid, though the weight per unit space (1,000 cubic feet) changes slowly. This means that provision should be made for a slow or uniform rate of flow, by making the pipes and vessels which are to convey or to contain the hot gases larger than the pipes for the same gas cooled. A 12-inch works should not be 12 inches throughout, but the design should have regard to temperature. If this is not done, the high rate of flow induced causes the gas to carry forward the water and tars, and a deposition occurs where there is a decrease in speed, as in the purifiers, or a change of direction, or frictional contact, as in a zig-zag scrubber, or a P. & A. condenser. Where the pipe for the meter inlet is 12 inches, the main entering the apparatus which shows 183° and saturation could properly be 20 inches in diameter, for a uniform rate of flow. Area of 12-inch = 113.10, $113.10 \times 2.707 = 306.16$; area of 20 inch = 314.16. This seems unnecessarily large, and expense of installation would modify the possibility of such adaptation.

At the low temperatures, the variations in volume of gas and vapor, and in weight per unit space, are very slow. Yet where a gas has not been kept from contact with water, it can carry enough of moisture and oils to stop the holder inlets with naphthaline when the needed reduction of temperature occurs. In the same way, if the gas is stored without the appearance of naphthaline, it can be, by the sun, heated in the holder; take up some of the liquor rich in naphthaline, which lies on the surface of the holder-water, take up also some of the water, carry both to an inconveniently cold service pipe and then drop them, as the most natural proceeding. This system of transfer would account for naphthaline obstructions at all seasons of the year.

Twenty years ago Major G. Warren Dresser read before the American Gas Light Association a translation of a paper[1] of Lucien Bremond, of Versailles, reviewing the effect of aqueous vapor upon naphthaline in gas, and the gist of the advice was, "Deprive the gas of watery vapor, and keep it dry until it reaches the burner."

In 1896, John Gimper, before the Western Gas Association, writes,[2] in reply or advice to F. C. Sherman, "I believe that if the moisture were taken out of the gas, the naphthaline could be left in the gas without damage."

The moisture can be removed by cooling and by time, but temperature and rate of flow are interdependent, and to act without consideration of both is to prepare trouble for a succeeding day. But the moisture cannot be removed below the saturation corresponding to lowest temperature in the works, unless the gas is passed through a drier, as quicklime; nor, in case of subsequent rise in temperature, can the moisture be kept at the point corresponding to saturation for the lowest temperature, unless the gas be kept from contact with water.

It is surprising to note the rapidity with which the gas is made, condensed, washed, scrubbed, purified, measured and stored. In the Flannery works, at Calf Pasture Station, Boston, the time taken by the gas, from the moment of its creation to the moment of its arrival in the holder, in midwinter, was just 5 minutes. At the maximum rate of make now noted with the Lowe works, it is about 6 minutes; while at the average rate of make, 11 minutes elapse between the time the gas leaves the superheater and the time of its arrival at the holder. This is traveling on schedule time, and allows small chance for change en route. Under these circumstances care is given to the gas at every point of its journey. Six hundred thermometric readings per day are taken of the gas and of the neighboring air and liquids; and the system, begun in 1887, has been continued during ten years, so that there are now nearly two million statements of temperature on file at this Station. It is an old apothegm that "the money is made or lost in the retort house," and it could be added that "the candle power is always made in the retort house, but is often lost in the condensers;" meaning, by condensers, any pipe or place where the temperature is lowered.

Temperatures above the boiling point cannot be neglected. The knowledge of the temperature at which the flue gases are entering the boiler smokestack will (with an analysis) endorse or condemn the work of the boiler maker and of the fireman, and disclose the efficiency of the boiler service. The thermometers in the steam calorimeter will tell whether you are supplying the water gas generators with hot water, for the generator fires to turn into steam before gas making can begin. The thermometers in the oil pipes will reveal the correct temperature for best service. A thermometer on the feedwater to boilers may suggest a possible economy.

Temperatures cannot be known without thermometers, and as to accuracy of reading, I have found many forms satisfactory, each having an advantage for special location, whether as to durability, accessibility, legibility or safety. Expense is a factor in selection, and accuracy is desirable. But the accuracy need be no more than reasonable; in some places the temperature should be known closely, while at other points some latitude is permissible. Reliable readings can be taken on gas where the rate of flow is high and the volume large. The presence of moisture and its amount have an influence upon the quick response of an instrument to change of temperature. Where gas is dry and light and the pipe small and the flow slow, it is necessary to insulate the thermometer, that the record may not be the temperature of the pipe nor of the air about it.

There is no instrument of equal cost that can render equal service with a thermometer, and its service does not end with the works. A reference to the report of the Gas Inspector of Massachusetts for January, 1895, will show that by heating the gas and air—*i. e.*, by warming the photometer room—the candle power of the gas increased with rise in temperature. Temperature, therefore, plays an important part and must be continually considered in the design and operation of a gas works, in the storage and distribution of the gas, and in its consumption and valuation.

*Discussion.*

The President—Gentlemen, you all know how important a factor the thermometer is in any gas works, and I hope there will be a very general discussion on this paper. I rather hope that Mr. McKay, before he leaves the subject, will give us some idea of what temperatures are best (as he has found them) in the course of manufacture at the Calf Pasture works, where so many thermometers are placed and so many records kept—that is, the proper temperatures for different parts of the apparatus in the course of the manufacture of the gas. I hope, gentlemen, that you will enter into this discussion freely, ask any questions you wish and make any suggestions that you like. Mr. Gifford has given quite an amount of attention to some like matters under his supervision, and I think very probably he knows a good deal about thermometers and temperatures. Mr. Gifford, have you got anything to say?

Mr. Gifford—It is rather throwing the burden of proof on weak shoulders. I was unfortunate in not hearing the whole of the paper, I am sorry to say. I can heartily agree with Mr. McKay in his estimate of the value of thermometer readings, and in our works thermometers are interspersed at various places. Their readings are recorded, and sometimes we take some notice of the readings with a view of changing our practice accordingly. I know it is frequently asked, in a sort of slighting way, "What is the use of all this thermometer reading and record business?" But I firmly believe it is of value, for, as one of our members said at a smaller meeting the other day, unless we keep in close touch with every pulse of our works, we are not going to keep up with the procession. And certainly this matter of condensation is one which is very important. As to the different styles of thermometers,

1. See JOURNAL, Vol. XVII., Nov. 14, 1877, p. 206.
2. See JOURNAL, June 1, 1896, p. 848.

the question of insulating thermometers was raised at the last meeting of this Association. In our practice we have found the most feasible thing to be a very simple thermometer, perhaps the simpler the better; preferably a plain glass tube put through a common cork. When you break it another costs but little. Of course, it is more liable to break than one incased in metal; but it is, in our experience, much more likely to give correct readings; and for ordinary pressures there is no trouble in placing them that way.

The President—Mr. Ramsdell, what is your experience in the matter of temperature in the works under your charge?

Mr. Ramsdell—We have not as yet a complete system. We started on a system about 2½ years ago, I think, but have not carried the matter out in all departments as yet. We are working on it, however, and consider it one of the most important features in the whole system of manufacture. I would like to ask Mr. McKay what his experience has taught him to be the best average temperatures for the different parts of the apparatus. I presume that this would apply approximately in all classes and sizes of works, the temperature being about equal whether the works are upon a large scale or not, after the initial degree of manufacture.

The President—Mr. Boardman, have you gone into this question of temperatures?

Mr. Boardman—I have not gone into it very largely, but as you have invited me to speak I would like to say that the two papers last read—the one in regard to distribution and the one in regard to the temperatures throughout the works—bear quite a close relation to each other, especially as effecting the deposition of naphthaline. I think they present a very strong argument to us to give particular attention to temperature and to pressures. They are in a measure interdependent. The depositions of mechanically contained mixtures takes place by reduction of temperature, or by a reduction in pressure, causing a corresponding reduction in temperature. Reduction in pressure in mains causes at certain points, where larger mains flow into smaller ones, having less pressure, quick motions, and therefore an impinging and a bombardment of molecules, and a deposition of the sustained particles of naphthaline and other impurities, as is the case in the P. & A. tar extractor. And this is accelerated by the decrease in temperature which always accompanies a sudden decrease in pressure. And I think that the two papers taken together should impress upon us the importance of keeping our pressures and our temperatures about as equal as possible and with the fewest changes. And, as a tentative matter, I think it demands a good deal of study and a good deal of thought. I am very much interested in all the matter brought out by the papers and the discussion, but am afraid I cannot add anything definitely to it, merely suggesting that those two points, to my mind, bear a very close relation to each other and might be studied together.

The President—This subject brings up the important question of the proper temperature of gas as it passes out from the works into the street. That I think was practically the question which started the first talk in this Association on temperature. Has any gentleman anything to say about that? Mr. Fowler, what have you to say about the temperature in your works?

Mr. Fowler—We do not take a record of the temperatures of the gas as made in the works. However, from observations that I make personally from time to time, I know that the temperature is fairly even from the time the gas passes the exhauster until it goes into the station meter. But Mr. McKay has also spoken of one other thing, that is, the time that the gas takes in going through the works. And that leads me to bring up a thing which we heartily congratulated ourselves on this last fall. We started the manufacture of water gas in November of 1895, consequently, the first October that we had made our water gas was last October. In October of 1895 we had 550 naphthaline blow outs, and in October of 1896 only 150; without, so far as we know, any difference in the real course of manufacture, except that a certain proportion, probably about one-quarter, of the gas made in 1896 was water gas, the only other difference being that the pipes and all the machinery through which the gas passed had been very much enlarged. Personally, I believe that our immunity from troubles with naphthaline during this last year has been due to the size of the apparatus and the enlargement of the pipes, and to the slow flow of the gas through the pipes.

The President—Mr. Nettleton, have you anything to say on this subject?

Mr. Nettleton—No, sir.

The President—Mr. Jenkins, something has been said in regard to the effect of temperature upon the tests of the illuminating power of gas at the photometer. What have you to say about that?

Mr. Jenkins—I have nothing more to say than is contained in the report. I had my attention called to the fact that the testing of gas in a cold room gave a lower candle power result. I have made a number of tests of open burners and also Argand burners, and I found there was a material variation in the candle power, due to the temperature with open burners. For that reason I thought it was a very important idea to have the temperature of the testing room fairly equable.

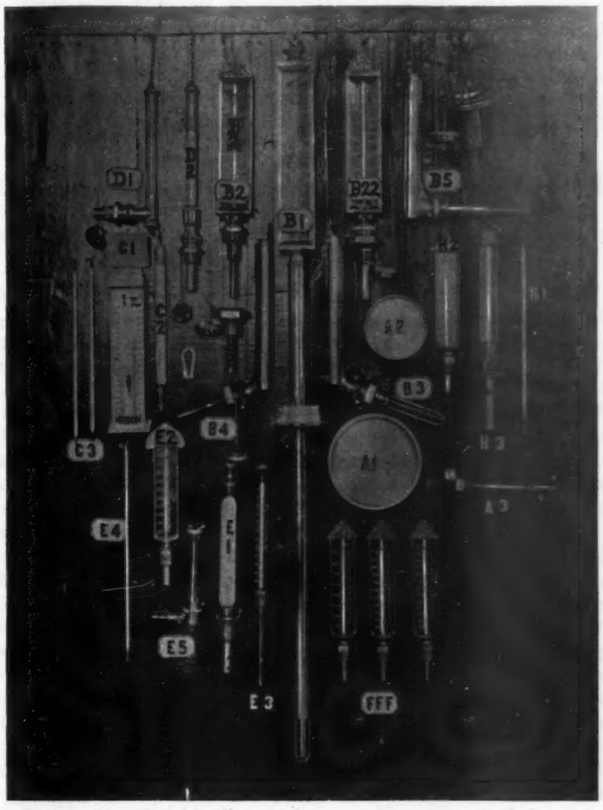
Mr. Egner—Perhaps a recent experience of mine might be of value to some of the members, taken in connection with the subject. It happened only last week, when the manufacturing plant was taken out of my hands and into those of my successor. Unknown to me the water was turned on full on the condenser (it was an improved Lowe apparatus) and keeping it quite cold. In consequence, inside of 10 hours we had the scrubber so full of naphthaline that it obstructed the free passage of gas, and even had choked up the by-pass to the apparatus. The candle power fell from 22 (by jet photometer) to 10 or 12. Now, here is an object lesson bearing directly on what has just been talked about. The gentleman who had taken charge knew very well what ought to be done, and, as soon as the cause of the obstruction was discovered, applied the remedy. In telling this story, I desire it to be particularly understood that there is no intention to imply ignorance or wilful neglect on the part of anyone. In consequence of the recent change, we were all perhaps a little upset, and this matter was simply overlooked; that was all. The water being turned full on the condenser and scrubber chilled the gas suddenly and thus caused a rapid deposition of hydrocarbons in the shape of naphthaline. You can guess what a time we had to clean it out, with the holders quite low and not much gas on hand, and a dark day at that.

Mr. Addicks—I think we all owe Mr. McKay a debt of gratitude for the amount of work that he has put into getting up this table. I do not know that any of us are in a position to discuss the matter as the value of the subject deserves. It seems to me one practical application that we can all make during the coming year would be of great service, and that is in the instance of determining something more in the direction of leakage. Mr. McKay in a practical way has given us a table that we can use thus as I understand it, and we will be able to determine that proportion of the unaccounted-for gas other than leakage which can only be determined by this table in combination with the temperature of the gas in the mains and the temperature of the gas as it leaves the works, as well as the temperature of the gas at the meter. It seems to me he also has pointed out something in the direction of a definite knowledge of naphthaline. Another important thing is as to a determination of the point at which we can stop condensation, or at which we could stop condensation in the bottom of the purifier. If the value of this paper stops with the discussion, I think we will lose the meat of Mr. McKay's paper and will not utilize the work that he has put into it. I trust that the matter may be taken up at the next meeting, and we will have some definite figures. I would say that, since about last May, we have been endeavoring to get at the quantity of condensation in our pipes, with a view to determining just what is water and what is oil. That experiment is still incomplete, and the quantity of water to the quantity of oil has a very direct bearing on this question of unaccounted-for gas. I trust that the members will pay particular attention to that line of work which Mr. McKay has hinted at, and that we will hear something definite next year about it.

The President—We should be very glad to hear from any other gentleman. Mr. McKay, will you kindly answer the questions asked, and give some explanation of the thermometers which have been so kindly sent, as I understand, by the manufacturers?

Mr. McKay—Mr. President, as to the best temperatures for gas works, it would be presumptuous in me to set forth the figures that we use as being a guide to any other places. In the first place, we are limited in the amount of water we can get for condensing. That modifies our action considerably. In the second place, we observe the temperature of the gas going out of the holder into the street main, and, knowing that temperature, it is useless at any point in the works to cool the gas below that figure. That is the controlling temperature so far as the condensation goes. For instance, during the month of January of this year, the average temperature of the gas leaving our holder was 42.8°. There would be no use in cooling the gas lower than that. On the other hand, there is a great deal of use in getting it down as low as you can, conveniently, towards that point, because you recover all the drip liquor and all the oils for some other use, instead of allowing them to get inside the holder and to lie on the holder water; and in the summer time, when the gas in the holder is heated by the sun to a very high temperature, allowing these naphthalines to be taken up again at an inopportune moment and carried off into the

mains to give a great deal of trouble. During the month of January, this gas which left the holder at practically 43° was carried through nearly 6,000 lineal feet of 30 inch pipe (giving a superficial area of about 50,000 square feet), and the gas was in the pipe 12 minutes; that is to say, the gas flowed at the rate of 2,340 cubic feet a minute. Now, in that pipe the gas dropped just 3-100ths of a pound of water, and about twice that amount of liquor. That 3-100ths of a pound of water, on a reference to the table, you will find corresponds to a definite reduction of temperature in the pipe. In other words, the gas entered that pipe at an average temperature of 43°, and if you find out how much the 3-100ths of a pound corresponds to in reduction of temperature, you will find then at what temperature the gas left the other end of the main. A converse process applied to any works of any size will enable you to determine whether your gas is flowing too fast or not; in other words, whether your pipes are too small. If you will take the temperature at any two consecutive points and collect between those points all the condensation (water) that is thrown down, if the condensation corresponds to the water which should be thrown down according to the table, then the design is all right. But if you do not get that much water thrown down, then the pipe is too small; you are mechanically carrying forward this moisture and liquor and naphthaline, and it is only reasonable to expect trouble in the service. We have had at times a great deal of trouble with naphthaline in our gas, and, as nearly as we can tell, we have taken out from time




to time half a ton out of one holder pipe, but we never have had any trouble after the gas left the works. And you can see why, because it travels through this condenser, which is not nearly the 6,000 lineal feet above referred to, but perhaps twice that length in all—one great condenser; so by the time the gas gets to any service pipe it is thoroughly deprived by friction of any excess of moisture or naphthaline, condensing liquors or vapors. As the temperature through the works varies at different times of the year, I like to get the temperature of the gas down, before the gas enters the purifying material, as low as convenient, and as low as I can with all the appliances at hand and a reasonable consumption of water. We have for a long while weighed all the material we put into our purifiers, and we have measured all the liquid that was thrown down and weighed the material taken out, so that we know just how much moisture is left by the gas in passing through the purifier. The same practice can be applied to any point of any gas works, and if there is any trouble with naphthaline or through sudden condensation or anything of that kind, the fact will be shown by a very simple practical measurement. These thermometers were loaned in order to show what forms of apparatus can be used in the gas works, on invitations extended to 7 manufacturers. There are a good many in this form (*B*2, *E*2, *FFF*, *H*2), which is simply an ordinary glass tube encased in a bulb in which is mercury or some similar liquid. This form (*A*1) is convenient for reading, the large extent of the dial making it convenient and making easy work for the person who has to take the data. This long thermometer (*B*1) is for taking the temperature of flue gases, either in retort work or in boiler work, in taking the temperature of gases leaving the stacks. This thermometer registers about 1,200°, but mercury does not boil except above about 676°, and if in any boiler, the flue gases leave at a temperature above 650°, in other words, higher than can be read by the ordinary chemical thermometer, there is something wrong with the way the boiler is run or constructed. This thermometer (*B*3) was specially constructed for our experimental work, and is insulated where it passes through the main. I used this on high temperatures and wet gas with a high rate of flow, and I find the indications are very close to those of an ordinary thermometer. However, on a smaller surface it might be necessary to have the insulation. These thermometers (*B*2, *B*22) are feed-water thermometers, with a separable case. The case can be screwed into a fitting, or into a hole tapped into any main, and the benefit of it is that the thermometer can be removed and shifted while the pressure inside the pipe can be sustained; for example—the case is very convenient to use if you want to take the temperature of steam, to see whether steam is dry or superheated, or loaded down with water. And this separable case is also convenient in a hot feed pipe or on an oil pipe. The danger from hot oil is very great both to the men and to the building near it, and the thermometer can be safely handled when you have a separable case of this sort. I find that the case and thermometer put together give reliable readings on liquids; I haven't tried it on gas. This thermometer (*C*1) is what is known as a maximum and minimum thermometer. I saw one in use in a meter room to show the greatest variation that occurred from day to day in the temperature of the air in the meter room, as influencing the registration of the gas. The mercury, in moving in one arm, carries a little steel piston inside the tube with it, and will leave that at the highest temperature, when the mercury recedes. And in the other arm another piston is similarly left at the lowest temperature. Then the steel piston can be returned to the mercury with a little magnet, and you will have it ready for the succeeding observation. That would be of considerable utility when there is any reason to expect a variation of the temperature more extreme than is desirable. This thermometer (*B*4) is constructed on an obtuse angle, the idea being that if it is set into the pipe square it throws the stem forward for convenience of reading. In the same way, if the stem is set into the pipe in a vertical position, the tube is inclined a little from the horizontal, so it is a great deal easier to read, and adds to the convenience of the observer. This thermometer (*B*5) is for use in making a flange connection where pressure may be expected. This (not in cut, broken before photograph was taken) is an ordinary low priced and an accurate thermometer, which can easily be made; and by being passed through cork, in the way several gentlemen have spoken of, that can be secured in a bushing, you can put it into any gas pipe at any point. It makes a convenient form of thermometer, low in price, and the cork is a good insulation. These other thermometers are what are known as chemical thermometers (*C*3, *E*4, *H*1), and they can be used with the cork in the manner Mr. Gifford explained. If there is any leakage it can easily be stopped with a little red lead. These other thermometers (*A*2, *A*3) are operated by the expansion and prolongation of metal inside of the case, the expansion or prolongation having been experimentally determined, and the reading of the thermometer gauged experimentally before it is sent out for use.

Mr. Allyn—Mr. President, I understood Mr. McKay to make the statement that there would be no use in reducing the temperature of the gas in passing through the apparatus below the temperature of the outside air. Now, it would seem to me that in the summer, when the temperature outside is perhaps 80° or 90°, if we pass gas through the apparatus at that temperature, there would be a large amount of tar carried forward through the condensers into the purifiers. Perhaps I did not understand him correctly.

Mr. McKay—The limit in the temperature spoken of was not of the air but of the gas leaving the holders; that is to say, the gas in the main as it leaves the holders, if the flow is reasonably slow, is saturated both with aqueous and with hydrocarbon vapors; it is saturated to a temperature corresponding to that which is indicated on a thermometer in the pipe at the holder. There is no benefit in reducing the gas below that temperature before it goes into the holder, for if you do, when it

goes into the holder it will rise in temperature and take up water and vapor corresponding to that temperature. The gas obeys a known law, and the vapor corresponding to saturation for given temperature and pressure cannot be controlled physically in any way. The one way in which increase of water vapor could be prevented would be to flow some kind of oil over the water inside of the holder. Then you could reduce the temperature of the gas, and it would not take up anything in the holder and would go out into the mains not saturated.

Mr. Allyn—The point I was trying to make was this: A couple of years ago we had a stoppage in a feed pipe of our condensers we were cooling with artesian well water to a temperature of 54°—the thing had been going on, I suppose, several days before we discovered it—and the result was that the tar passed the condensers and found its way into every piece of apparatus in the works. Now, it would seem to me, when the gentleman speaks of the temperature in the holder, that in an outdoor holder exposed to the full rays of the sun, the temperature of the gas would not be much below the temperature of the air. And certainly, if you do not reduce the temperature of the gas below 80° or 90° during the summer months, it would seem to me that a large amount of tarry matter would go forward into our purifiers. The gentleman says, if you lower the temperature and remove the water the gas is sure to take it up again in the form of water after it enters the holder. I would a good deal rather it would take water up than carry tar forward,

Mr. McKay—The amount of water in the gas is independent of anything else. The oils give up vapors and will furnish those vapors independent of the water, and if there is oil condensed on the surface of the holder water that will be taken up the same way; but if the gas does carry forward tar and oils that ought not to be in it, at a temperature of 80°, it is because it is moving too fast through the apparatus. And for that reason it might be well, where the gas has to go at a certain rate, which you cannot control and where you do not desire to increase the capacity, to reduce the temperature, and then let it rise again in the holder.

The President—Are there any other questions any gentleman would like to ask Mr. McKay? I myself wish to suggest a vote of thanks to Mr. McKay for the work which he has done. A hasty glance hardly gives one an idea of the work of preparing such a paper as Mr. McKay has read. If you will study it you will see that there must have been a great many hours of laborious work put into that table of figures. I think it is the duty of the Association to show appreciation of work of this kind among its members. I therefore hope, gentlemen, that you will vote as I ask you to, to extend to Mr. McKay a vote of thanks for his carefully prepared paper upon this subject.

(The vote of thanks to Mr. McKay was then put and unanimously carried.)

Mr. Gifford—Mr. McKay asks me to present the following motion: That we pass a vote of thanks to the following manufacturers who sent these instruments for exhibition:

*Thermometers Shown in Photograph.*

*A* 1, *A* 2, *A*3.—Dial thermometers, fitted for screwing into a main or plate, made by Standard Thermometer Co., of Peabody, Mass.

*B* 1.—Long stem thermometer, with gas filling in the bulb at upper end of tube; the expansion of the mercury as temperature rises causes the gas to exert an increasing pressure, and the mercury is thus prevented from turning into vapor. In this way the registration can be carried as high as 1,200° with mercury.

*B* 2, *B* 22.—Separable thermometers, having an outside casing for the attachment to a main or plate. *B*2 shows the case for the stem just below the thermometer. *B*22 shows thermometer with casing attached.

*B* 3.—Obtuse angle thermometer, with open stem protected by cage and fitted with insulation at point of attachment to pipe or plate.

*B* 4.—Obtuse angle thermometer, with separable stem casing.

*B* 5.—Right angle thermometer, with flanged stem casing for attachment to plate by bolts.

*B* 1, *B* 2, *B*3, *B* 4, *B* 5.—Made by Hohmann & Maurer Mfg. Co., of Rochester, N. Y.

*C* 1.—Maximum and minimum thermometer, for automatic registering.

*C* 2.—Chemical thermometer, glass cylinder and paper scale.

*C* 3.—Chemical thermometers, solid glass and porcelain scale.

*C* 1, *C* 2, *C*3.—Made by C. J. Tagliabue, of New York, N.Y.

*D* 1, *D* 2.—Right angle and straight stem thermometers, with exposed bulbs protected by perforated metallic casing, made by American Meter Co., of New York and Philadelphia.

*E* 1, *E* 3, *E* 5.—Straight stem and right angle thermometers, with exposed bulbs protected by perforated metallic casings. *E* 1 fitted with a metal guard which can be revolved so as to cover the register.

*E* 2.—Pipe thermometer, with covered bulb (immersed in mercury bath.)

*E* 4.—Chemical thermometer, with nitrogen filling above the mercury, and scaled to register above 1,000°.

*E* 1, *E* 2, *E* 3, *E* 4, *E* 5.—Made by Queen & Co., of Philadelphia.

*FFF.*—Pipe thermometers, with covered bulb immersed in mercury bath, made by Schaeffer & Budenberg, of New York and Brooklyn.

*H* 1.—Chemical thermometer, solid glass and porcelain scale.

*H* 3.—Pipe thermometer, with cylindrical guard for bulb, and with revolving guard for register.

*H* 2.—Pipe thermometer, with covered bulb immersed in mercury bath.

*H* 1, *H* 2, *H* 3.—Made by J. S. F. Huddleston, of Boston, Mass.

The motion was carried.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

Mr. Nettleton, on behalf of the Committee on President's Address, read the following report:

The Committee to whom was assigned the task of reporting on President's Address desires to express its great appreciation of the masterly way in which the many topics were treated, and at the same time its regret that, with the time allowed, a thorough report worthy of the address cannot be prepared.

A *résumé* of the history of the last year, of the changes in the business situation, of the many attacks the industry has withstood, and is still called upon to withstand, written by the able hand of our President, is indeed worthy of the close attention and study of each member of the Association, and we commend it to their careful consideration.

CHARLES H. NETTLETON,
SAMUEL J. FOWLER,
FRANK S. RICHARDSON, } Committee.

On motion of Mr. Harbison, the report was accepted and made a part of the official record.

The President introduced Mr. S. J. Fowler, of Springfield, Mass., who read the following paper, entitled

## SOME REMARKS ON COKE OVENS AND THEIR PRODUCTS.

On account of the many onerous duties falling upon his shoulders, our honored secretary has requested me to read for him a few remarks on the subject of by-product coke ovens and their bearing on the gas industry.

That this subject had any especial interest for the gas profession in New England was unknown to most of us until last winter, when with a great flourish of trumpets, and the loudest protestations of philanthropy, it was proposed to re-estab'ish the iron business of Massachusetts by manufacturing coke on the seaboard and, while utilizing the solid products of distillation where made, to distribute the gaseous products all over the State. The scheme is one which has often been proposed for other localities and as often proved impracticable; but, like perpetual motion, it is always finding some one who will give time and money to it. In this case of last winter the time and trouble might have been expended to the profit of the promoters, if the original scheme had gone through, for then the various local gas companies, now beneficently conducting their business under the wise laws of this Commonwealth, might have become the prey of the promoters, and their customers have suffered in the corresponding way.

When exposed to the proper degree of heat in closed vessels, bituminous coal of the so-called coking variety is resolved into two divisions—the solid, called coke, and gases, some of which become liquids at ordinary temperatures. It has been and is customary to conduct the heating of the coal according to whether the object desired be to get the solid material in the best shape, perhaps at the cost of the gases and liquids, or to get the distillates in the most valuable form. In the first instance, coke being the object desired, the beehive form of coke oven is commonly used, and all the gases and liquids are usually wasted. In the second case, the coal is treated in retorts of the form and setting to which we are so well accustomed in our gas works. The apparent waste, however, of valuable products in the beehive oven process has long been noticed, and for many years it has been one of the problems of inventors to find a way to utilize this waste without in any way depreciating the quality of the coke; for coke, to meet the requirements of the iron manufacturers, must be heavy and hard, so that when it is put into an iron furnace it can resist the crushing weight of the ore and limestone and fuel which is super-imposed upon it. The coke made in the ordinary gas retort is so light and soft that it cannot even stand the weight of iron in the ordinary foundry, though for other

## Longitudinal Section through Flues

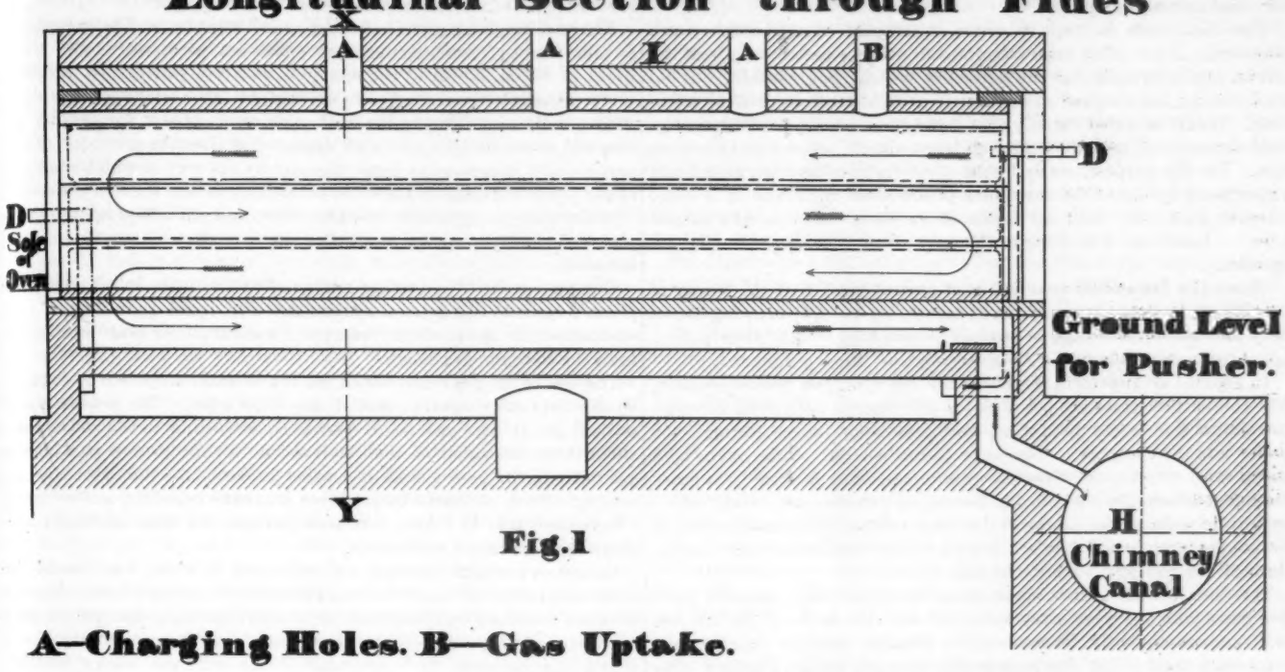



Fig.1

**A—Charging Holes. B—Gas Uptake.**

**D—Inlet of Gas to Oven Flues.**

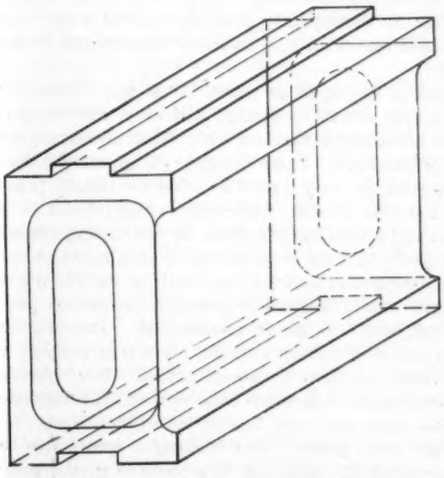
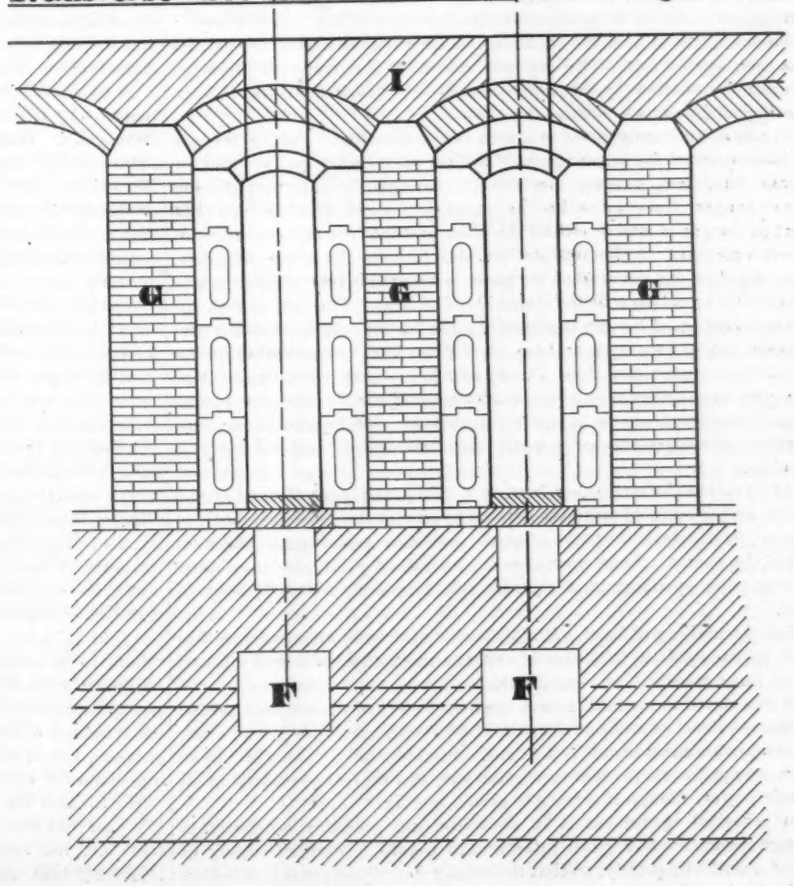


Fig. 2

Fig. 3

Transverse Section on XY Fig. 1




THE SEMET-SOLVAY OVEN.

purposes it may be as valuable as the very best oven coke. Thus the efficiency of soft gas house coke for making steam in ordinary power plants is equal to that of hard coke and, weight for weight, it is as good for most domestic uses.

The coke made in beehive ovens is accepted in this country as a standard. It has often been attempted to utilize gases coming from the ovens, and to save the tar and ammonia which they contain, but no such scheme has attained so much success as to cause its general adoption. It can be stated broadly that if the gases from the distillation of coal are to be utilized, then the distillation should be conducted in a retort. For the purpose, many forms of retorts have been suggested and experimented on, but the one which is now most in vogue is a long, narrow, high one, built up inside of an arch with specially shaped tiles. I have here a drawing of the only oven I have personally inspected.

This is the Semet-Solvay oven, as at present located at the works of the Solvay Process Company, in Syracuse, N. Y. The drawing shows only one bench, as we say in our gas phraseology. The description I adapt from an article in the *Engineering and Mining Journal:*

In general arrangement the ovens are grouped one beside another. The combustion gases are led from the side flues of each oven through the bottom flue into a main flue, and pass from thence through the boiler into the chimney. The coke is pushed out of the ovens by a steam ram, which may be moved from one oven to another The gases disengaged from the coal during the coking process pass, first, into a hydraulic main placed on top of the block. From thence they are led to the condensers, thence they are drawn by the exhausters and forced, through the washers, back to the coke ovens.

The flues in which the combustion of the cooled and partially purified gases take place are independent of the brick walls of the arches, and can, consequently, be removed or repaired without touching the brickwork itself. For this purpose the flues are made of hollow tiles with their sides fitting one into another and forming a complete and tight circuit. In this way a solid construction is attained with very thin sides toward the coking chamber, which is favorable to the transmission of heat.

The dimensions inside the oven are as follows: Length, 30 feet; breadth, 1 foot 2 inches on the end toward the steam ram, and 1 foot 3 inches on the other end; height, 5 feet 8 inches. The brick walls are two bricks thick, or 16 inches, and the thin sides of the tiles 3 inches.

To avoid loss of heat the thickness of the brickwork over the arches has been made 4 feet. The cast iron doors of the ovens are protected against the weather by wrought iron doors, which also prevent the cooling of the outside ends of the ovens.

The heating arrangement is shown in the drawing. Part of the gas is introduced in the upper range of hollow tiles, on the end toward the steam ram, and, passing successively through the intermediate and lower ranges, descends to the flue under the floor of the oven. Another part of the gas is introduced on the other end into the middle range, as a reinforcement of the first portion, and follows the same channels. The object of this division of the gases is to avoid overheating certain points and to obtain a better distribution of heat. The air needed for the combustion of the gas is admitted close to the gas inlet and is previously heated to a temperature of 400° or 500° by circulation in the brickwork under the floor of the ovens. A proper arrangement of dampers in the flues regulates the admission of the air, and the admission of gas can of course be easily controlled. Consequently, the temperature of the retorts can be easily regulated and a uniform result is assured.

At Syracuse the coal is received on a side track near the end of the block, and is emptied from the cars on to an elevator, which raises it to a point from which it can be dropped into cars running on tracks on top of the ovens. From these cars the coal is dropped into the retorts through the openings *A A A*, each retort holding about 5½ tons of coal.

For the making of hard coke 24 hours is said to be necessary, so that each retort is able to take care of about as much coal per day as a bench of six large retorts in our gas plants.

It was stated to me that the gas made in excess of the amount needed to run the benches amounted to about 4,000 cubic feet per ton of coal, the coal containing about 30 per cent. volatile matter. There are, however, no appliances for measuring the gas, and no means of testing its candle power, though it seemed to give a fair light.

In practical operations it is desirable, and probably necessary, to change the retorts at regular intervals, to insure a regular supply of gas of a uniform quality, so that there may not be too great a variation in the heat produced by its combustion. Thus, if 12 retorts be running, a retort would be charged every two hours. If 24 retorts are running, one would be charged every hour, and, of course, for the economical manufacture of all the products, a regular course of procedure utilizing the whole plant is necessary the whole year through.

The coal handling plant to be economical must be used to its capacity, as must also the ammonia recovery plant, not to speak of the block itself, in which, however, the money is mostly invested. In the plant under consideration it seemed to me that the labor employed would not vary greatly according to the coal carbonized, except for getting the coal out of the elevator and then disposing of the coke produced. I was particularly impressed as a gas engineer by the way in which each part of the plant was adapted for every other part, so that the full utilization of every piece of apparatus was called for, and no adequate provision was made for keeping up production in case of accident or unusual demand.

Comparing the illuminating coal gas plant with the retort coke oven plant, I came to this general deduction. For equal quantities of coal carbonized the bye-product oven occupies about 50 per cent. more space than the common gas bench.

The cost of the gas retort bench per ton of coal carbonized is stated to be approximately equal to that of the retort oven. The production of utilized gas in the gas retort bench is, according to the above data, about three times that of the retort oven; for the greater part of the gas made in the retort oven is needed to heat it. Our own benches may be said to be heated by producer gas, but up-to date, and so far as I have been able to learn, producer gas has not been profitably employed to heat retort coke ovens.

Inventors are now working with this end in view, but should the experiment succeed it will be found that either a certain percentage of the coke produced by the ovens, or a corresponding amount of coal must be used to generate the product gases, and the process will more nearly approximate the operations of our own gas works, so that, apart from the physical characteristics of the coke, no better results will be achieved in any direction.

But excluding the possibility of using producer gas, and considering the coke oven as a producer of coke for market rather than of gas for market—for it must be either one or the other—it is plain that the investment per 1,000 feet of utilizable gas would then be three times as great in the coke oven plant as in the gas retort plant. The gross returns from ammonia would be three times as great from the coke ovens, and the return of coke would be from four to six times greater, on a consumption of three times the quantity of coal.

As to the value of the coke it is difficult to speak, but I can see no reason why it should ordinarily have a greater selling value than gas house coke. That, the plant being once erected, coal and coke can be more cheaply handled in retort coke ovens than in gas house retorts, is I believe a fact, and with the exception of the amount of ammonia produced, the only one which would make the production of gas by that means cheaper than by the ordinary process; but that is far from counterbalancing the differences in the amounts invested and in the quantity of coal needed.

And the gas produced is not equal to retort house gas. Naturally both the illuminating power and the heat units will vary, according to the coal used, and also according to the care with which the ovens are used as a gas making machine. Those long, built up retorts, with rather thin side walls, must be very liable to cracks. Indeed, I am informed that this is the real trouble with some ovens erected in a neighboring Province, and unless the exhauster be run with exceeding care, it would be very likely to draw in products of combustion to be mixed with the gases developed in cooking, especially at the end of the charge, when these gases would be small in quantity and poor in quality, and thus the product would be much deteriorated. It had been proposed to utilize this gas in Welsbach burners, for which purpose it would have a certain value, and also for domestic uses. For cooking it would be desirable, according to its calorific power, which is by some thought to be but a little more than half that of retort house gas; by others to be only 15 per cent. poorer. For heating it would also be valuable in the same proportion. And now I propose to give expression to an opinion on the subject of the value of gas for heating, and on the economy of the domestic consumption of anthracite coal for that purpose, which is founded on my experience of seven years in furnishing steam for warming all kinds of buildings.

We furnish for $1, 1,500,000 utilizable B.T.U. in steam or hot water. We find that this price is equivalent to $10 per net ton for anthracite coal—*i.e.*, our average consumer gets from one net ton of anthracite, 15,000,000 heat units. Theoretically, he should get at 12,500 B.T.U. per pound (25,000,000 B.T.U. per net ton). That he does get 60 per cent. of

the theoretical amount, or 75 per cent. what the very best boiler practice can obtain, vouches for the economy of the domestic heater. To obtain this same amount of heat by the use of coal gas, and allowing no loss, would require the use of about 22,000 cubic feet. Of coke oven gas there would be required from 26,000 to 44,000 cubic feet—in other words, to compete with coal at $6 per net ton, illuminating gas should be sold at 27 cents per thousand, and coke oven gas at from 14 to 23 cents; or, considering the unavoidable waste of combustion, 24 cents for illuminating gas may be said to be a fair charge. Or in other words, the value of coal gas for domestic heating is 4 per cent. the cost of anthracite coal.

In conclusion, I would say that since the bye-product coke oven furnishes harder coke than the gas house retort, there may be places where local demand may make it expedient to use that oven, and thereby to sacrifice the candle power and heat units in the gas supplied; but those conditions do not now exist in the district represented in this Association.

*Discussion.*

The President—Gentlemen, all of you who are from Massachusetts, and probably most of you from other sections, have got into your minds this coke oven question, largely because of the effort that was made here last winter by Mr. Whitney to get through the Legislature his pipe line bill. The scheme was started by Mr. Whitney in Massachusetts. It was also started in Cincinnati by practically the same people, and now another scheme is on foot at Hartford, Conn. A new bill has, within a few days, appeared in the Legislature in Massachusetts. All of these bills are for the purpose of doing what Mr. Fowler has described, making coke, and at the same time trying to make a cheap gas and distribute it over a large territory. At the time that this question came up in Massachusetts comparatively few of the engineers were posted to any extent, or at least they were not posted in a way that made them feel competent to go before the Committee on Manufactures and discuss the question. Since that time some of us have tried to get into some of these coke oven plants and study the question. The plants which we have wished to get into have been closed to us; but Mr. Fowler and some others have seen this plant at Syracuse, and Mr. Fowler and Mr. Prichard kindly consented, after some persuasion, to prepare this paper on coke and coke ovens for this meeting. Now, many of you must have questions that you want to ask Mr. Fowler, and I hope we shall discuss the question fully and freely. If we do not have time this afternoon to ask all the questions and receive all the answers we want, we will continue the discussion in the morning. Please take the matter into your own hands and ask any questions of Mr. Fowler you see fit. Mr. Fowler has a large box of samples of coke which he will explain. Mr. Addicks, will you commence the discussion?

Mr. Addicks—I do not think I can add anything to what Mr. Fowler has said. I had the pleasure of seeing these particular ovens in Syracuse, but as I went there without any letter of introduction I felt a delicacy about asking questions, and I was led to understand that it was all I could expect, to get into the works at all. I have nothing to add to what has been said. Mr. Fowler has thoroughly explained to you everything that I saw at that time.

Mr. Fowler—I have here some specimens of beehive oven coke, bye-product oven coke and gas house coke, and also a couple of pieces of clinker, which are the result of my endeavor last summer to use the coke made from Dominion gas coal in our U. G. I. generator. We couldn't keep a fire on account of the clinker.

Mr. Boardman—I would like to ask Mr. Fowler if it is claimed that the coke resulting from 24-hour charges in this apparatus is as good as the 60 and 72-hour coke from the beehive oven, for metallurgical purposes.

Mr. Fowler—I believe that claim is made, but how well it can be substantiated I can't say. The coke we saw out there was said to us to be a 24 hour coke. It seemed to me, as far as I could judge by the looks and appearance and feel of it, to be a hard, metallurgical coke. I presume this to be 24-hour coke, of which I have samples here, which of course you can examine.

The President—Gentlemen, I think it would pay you to have that piece of Dominion coal go around among you. (The specimen was then passed about the room.) We have heard a great deal about Dominion coal in the last eight months here. That is a piece of slag from Dominion coal coked in a furnace.

Mr. Sherman—I would like to ask Mr. Fowler, eliminating the bye-products of tar and ammonia, what advantage these coke ovens have over the beehives. There is a limit to the ability of the markets to absorb ammonia and tar. And suppose that they fall to a very low price, what advantage then would these people have over the old-fashioned beehive coke ovens?

Mr. Fowler—I have the impression that under those circumstances the advantage would be with the beehive oven; the beehive oven is so much cheaper—that is, per ton of coke produced—and it is very much cheaper in installation. If it were not for the bye-products I do not think these bye-product ovens would be used at all, or have any chance.

Mr. Sherman—It looks as if the bottom was going to drop out of the bye-products, for us and them, too.

Mr. Addicks—I would like to ask Mr. Fowler one question: On a given plot of ground, how much coal gas could be made, and how much coke oven gas; the relative figure?

Mr. Fowler—My impression is that the amount required for the carbonization of a certain quantity of coal, for the retort oven, is about 50 per cent. larger than it is in our common gas house process.

Mr. Harbison—I did not quite understand, when you were speaking about this clinker, whether that came from using the coal in your generator.

Mr. Fowler—This was gas coal from one of the Dominion coal mines.

Mr. Harbison—Did you use the coal in the generator?

Mr. Fowler—No; the coal was put into our gas retorts, where we coked it, and then we put the coke into our generators, and this is the result.

Mr. Harbison—A gentleman desires to ask the question whether in Syracuse they are selling the gas at all to the public, for illumination or fuel, or any other purpose.

Mr. Fowler—In Syracuse the Solvay Process Company is engaged in the manufacture of soda ash. The raw ingredients for that are limestone and salt. That Company gets the coke for burning limestone, and they get the lime and the carbonic acid in that way. They can use their own products, you see. The ammonia which is made in the distillation of the coal they also use as a means for separating the salt into its constituent parts of chlorine and sodium. The gas which is left over, which they say amounts to 4,000 feet a ton, is used there for melting down the soda ash.

Gen. Harbison—It is all used for their own operations?

Mr. Fowler—Yes, practically; although I believe they are selling some coke for foundry purposes.

Mr. Nettleton—Aren't they selling any gas?

Mr. Fowler—They were not selling any gas at that time. They have gas works there, and they used it themselves through their own works, using the rest for heating their boilers and furnaces.

On motion, a vote of thanks was passed to Mr. Fowler for his paper.

The Secretary then read a telegram, of wishes for a successful meeting, received from the Michigan Gas Association, in session at Ann Arbor, Mich. The Association instructed the Secretary to return a suitable reply, after which the Convention adjourned, to reassemble at 10 A.M. the following day.

[To be Continued.]

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Messrs. P. H. & F. M. Roots Company, of Connersville, Ind., inform us that they have made an arrangement with the American Gas Company, of Philadelphia, Pa., under which the latter will have exclusive rights to sell the Roots Company's exhausters and kindred machinery in New York, New Jersey, Pennsylvania and all the New England States. The New York city agency for the sale of the Roots' blowers, etc., will be continued at 109 Liberty street, this city, with Mr. J. B. Stewart in charge.

AT the shareholders' meeting, Port Jervis (N. Y.) Gas Company, held Feb. 24th, the Directors chosen were: George P. Wescott and George F. West, of Portland, Me.; H. E. Duncan, of Brooklyn, N.Y.; and L. E. Goldsmith and C. E. Cuddeback, of Port Jervis. The Directors subsequently perfected the following organization: President, Geo. P. Wescott; Secretary, C. E. Cuddeback; Treasurer, Geo. F. West; Superintendent, John Collins.

THE New London (Conn.) Gas and Electric Company has awarded the contract for the rebuilding of its works to the United Gas Improvement Company. As was intimated in the JOURNAL some time ago, the old coal gas plant will be abandoned, and the new plant will be erected on the plot adjoining the Company's electric station. The U. G. I. contract includes the placing of a standard double superheater Lowe water gas apparatus, of a daily capacity of 250,000 cubic feet, new purifiers, oil storage tank, etc.

MR. JOHN E. SIMPSON, for 20 years or more Receiving Clerk of the West Philadelphia office of the Philadelphia Gas Bureau, died on the morning of February 24th after an illness lasting only four days. Deceased was born in West Philadelphia, October, 1847, and was a graduate of the Central High School.

THE Indiana syndicate has purchased the gas works at Frankfort, Ind., formerly operated by the American Gas Company.

WE understand that the proprietors of the Rome (N. Y.) Gas Light Company have arranged to install a water gas plant this spring. The scheme of improvement includes also a considerable extension of the main system.

AT the annual meeting of the Jacksonville (Ills.) Gas Light and Coke Company the following result was reached: Directors, Isaac Rawlings, Edward S. Greenfield, John A. Bellati, William E. Veitch, William R. Routt, Frank M. Doan and Frank Elliott; President, Frank Elliott; Vice-President, Isaac Rawlings; Secretary and Superintendent, Frank M. Doan; Treasurer, John A. Bellati; Assistant Superintendent, J. Parker Doan.

THE following announcement was made by Mr. G. B. Hand, Secretary of the Scranton (Pa.) Gas and Water Company, on February 22d: "The Scranton Gas and Water Company and the Hyde Park Gas Company.—In accordance with the policy of these Companies, to reduce the rates from time to time, as may be warranted by increased consumption, notice is hereby given that, on and after April 1st next, the price of gas will be $1.25 per 1,000 cubic feet of gas consumed, subject to the following discounts: 5 per cent. on all bills where the consumption for the month amounts to less than $25; 10 per cent. upon all bills where the consumption for the month amounts to $25 and upwards, provided the bill is paid on or before the 20th day of the month in which the bill is presented."

THE authorities of Danbury, Conn., are considering the advisability of taking up the supplying of gas and electricity for that city on public account.

MR. CHARLES A. LEARNED, Superintendent of the Meriden (Conn.) Gas Light Company, recently arranged for a practical demonstration of cooking by gas in that city, the demonstration being made in the offices of the Company, on the afternoon of February 24th, Mr. C. W. Austin performing the cooking operations with a niceness and skill fully up to the very best method and practice of a Mrs. Rorer, or any other of the feminine experts in the cooking line. The Company issued a large number of invitations, by postal card, to the housekeepers of Meriden, asking them to visit its offices on the afternoon of February 24th, there to be entertained by witnessing an exposition of the merits of gas as a cooking agent. The result was that 125 ladies, thoroughly representative of the city's most substantial families, responded in person, between the hours of 2 and 5 P.M., and were all interested spectators of Mr. Austin's cooking demonstrations. The demonstrator cooked batches of biscuit, made delicious specimens of Parker House rolls, baked a series of cakes, roasted a rib of beef, broiled a steak, and so on, all the while, in easy, fluent speech, carefully explaining as he went along everything in connection with his task. The "kitchen" for the nonce was as clean and inviting as any "regular kitchen" could be; and the Directors' room, adjoining the main offices, where cakes and cocoa were served to the guests, was like a bower, because of the tasteful array of carnations and mignonettes provided by the hosts. In every sense the demonstration was a success.

WRITING of Meriden brings to mind the fact that the Company proposes this season to largely extend the main system.

THE United Gas Improvement Company is installing, for the Westchester Gas and Electric Company, of Port Chester, N. Y., a new set of standard double superheater Lowe water gas apparatus, the plant to have a daily capacity of 250,000 cubic feet.

SOME four years ago the Berlin Iron Bridge Company, of East Berlin, Conn., designed and built a stove works at Sioux City, Iowa, but, owing to the failure of the stove concern, the contractors were obliged to take back the foundry building, mounting shop and general machine shop. The Bridge Company now offers these buildings, which are of excellent iron construction, for sale at a bargain. The buildings are only second-hand in the sense that they were erected—they were never used. The Bridge Company offers them for sale at a price which is low enough to warrant an inquiry from anyone contemplating construction on the lines indicated.

THE project to establish a gas company at Winthrop, Mass., has been revived, and application has been made to the authorities for a governing ordinance. The capital stock has been put at $25,000, and the officers of the concern are: President, Constant Q. Ring, of Winthrop; Treasurer, H. A. Root; Secretary, George L. Weill.

MR. JAMES R. FLOYD, JR., has accepted a responsible position with the California Asphalt Company, 57 East 59th street, New York.

MR. BOARDMAN HALL appeared before the Committee on Manufactures, of the Massachusetts Legislature, on February 26th, to advocate a petition for an Act to incorporate the Commonwealth Gas Company. He gave the names of the proposed incorporators as follows: A. B. Coffin, of Winchester—formerly a member of the State Gas Commission; G. M. Emery, of Mansfield; I. H. Davis, W. C. Johnson, Buffalo, N. Y.; E. B. Marsh, of Lexington; Dr H. M. Jernegan, of Boston; L. L. Tower, of Boston, and himself. He stated that out of 352 towns and cities in the State only 92 had a gas supply, but that it was not the purpose of those who ask for this incorporation to go into any territory where there is an existing Company. It was proposed, if a charter were granted, to set up plants in small towns having no gas works, and keep the plants in operation only a few days in a month, for enough gas could be made in two or three days to supply the town for the rest of the month. The petitioners could incorporate under the general laws, but if they did so a separate Company for each town would have to be organized, which was not desirable. It was proposed to make coal gas. Mr. Hall also said that while the bill asks the right to put the capital stock at $1,000,000, with authority to increase it to $10,000,000, the petitioners would ask the right to make the capital less than the minor sum named.

THE twelfth annual report of the Massachusetts Board of Gas and Electric Light Commissioners, dealing with operations of the gas and electric light companies of that State, for the twelvemonth ended June 30, 1896, has been handed into the Legislature. As usual, it bristles with interesting facts and figures, and the Board is to be congratulated over the very succinct way in which its labors are reported. In abstracting from its tables and statements we find that the gas companies, during 1896, made an apparent net profit on their gas business of $1,824,398, and received in addition, for interest, rents and profits from the supply of electric currents, a sum sufficient to bring the total up to $2,223,977. From this should be deducted interest on bonds, dividends, etc., amounting to $1,865,779, the net result being a surplus of $358,198 for 1896, as against a deficit of $286,949 in 1895. The total amount of dividend declared during the year was $1,068,649. The value of the gas plants, as assessed by the local authorities for purposes of taxation, is $17,500,000. The total sum paid by the companies for taxes, including State supervision, after apportioning to electric account that part of the gas companies' revenue chargeable to their electrical departments, was $291,653.84, an average of 5.4 cents per 1,000 feet of gas sold; being an increase over the amount paid the previous year of $19,843.13, and a decrease of six-tenths of a cent for every 1,000 feet sold. The average price paid by consumers for coal gas to the companies, selling annually more than 30,000,000 cubic feet each, is $1.12 per 1,000 feet. If the Boston and Brookline Companies be excluded the average is $1.22. The average price received by the remainder of the coal gas companies, from sales by meter, is $1.68, making an average for all of $1.17 per 1,000. If the amount sold by the Bay State to other companies is included in the computations, the average price received by all the companies is $1.05 per 1,000, and by those selling annually more than 30,000,000 feet is $1. The average price for oil gas is $3.93 per 1,000. The average price paid for coal gas in 1886 was $1.72; in 1887, $1.66; in 1888, $1.56; in 1889, $1.45; in 1890, $1.39; in 1891, $1.31; in 1892, $1.28; in 1893, $1.27; in 1894, $1.26; in 1895, $1.10. Reductions in price were made by 15 companies during the year, and one company (the Citizens, of Reading), increased its rate. Eighteen companies failed to pay dividends, and of the 51 remaining companies, the maximum return was 12 per cent. (by two companies), and the minimum return was 1½ per cent.—by the Webster Company. The average dividend return per annum, of the 51 paying companies, was 6½ per cent. During the year 54 companies extended their main system, the maximum addition having been 11 miles, and the minimum 168 feet; the total addition was virtually 104 miles. The total number of meters in use, June 30, 1896, was 166,295, representing a nominal capacity of 1,073,974 lights, showing an increase over 1895 of 15,894

meters and 79,256 lights. The greatest increases in meters were shown by the following companies: Brookline, 4,865; Dorchester, 1,156; Cambridge, 800; South Boston, 771; Roxbury, 757; Lowell, 669; Fall River, 579; Worcester, 575; Springfield, 544. Two companies report fewer meters set—Citizens, of Reading, 27; Spencer, 50. Fifty-seven companies report a total of 70,290 gas stoves, etc., in use. The Brookline Company has the greatest number out—19,002; while Amherst and Lexington report one each. This gas stove return is especially interesting, as showing what may be accomplished in this direction by intelligent management in even the least populous centers. Public lamps maintained are 263 fewer than for the previous year. There are only 11,656 public gas lamps for street lighting in use in the State. The average candle power of the gas supplied (excluding that by 9 oil gas companies) during the year was 19—maximum, 28.2; minimum, 14.6. The average illuminating value of the gas supplied by the 9 oil gas companies was 34.12 candles—maximum, 54.7; minimum, 20.4.

A BILL is before the Legislature of North Carolina which declares that the maximum rate for gas in that State shall not exceed $1.50 per 1,000 cubic feet. It will not become a law.

THE Judiciary Committee of the New Hampshire Legislature has reported adversely on the bill to regulate price and quality of gas in that State, by vesting power on such account in the mayors and aldermen of cities or selectmen of towns.

THE following is the text of the gas bill submitted by Mr. Lindner to the consideration of the California Legislature:

Section 1. No individual, firm or corporation furnishing gas shall require any deposit from the owner of any building in which and for whom a meter is furnished, but upon the request of a tenant or lessee of a building or room such individual, firm or corporation may demand and collect a deposit not to exceed $2.50 in cases where such building or room contains 10 or less burners, and a deposit of $5 in cases where the number of burners exceeds 10, and any money so collected by such individual, firm or corporation shall be placed to the credit of the gas account of the consumer, and the meter shall not be removed nor the gas shut off from the premises of such consumer while there remains a balance to his credit upon the books of such individual, firm or corporation.

Sec. 2. Every consumer of gas shall be allowed to apply on the house side of the meter any device for saving, regulating or measuring the gas, he to assume any expense or damage that may result from so placing such device or machine.

Sec. 3. The Board of Trustees, City Council or other governing body of any city, city and county, or town, in the State of California, may, in its discretion, change and regulate the price of gas and provide for the inspection of the meters furnished consumers in such city, city and county, or town.

[No. IV.]

## Some Details of the Displays at the Recent Gas Exhibition, Madison Square Garden, New York, under the Auspices of the Gas Industries Company.

The meter makers of the country were well represented at the Exhibition, and, as a rule, the non-professional visitor put in a great deal of his time at the various meter booths, particularly in those which made a feature of the prepayment meter and its workings. The American Meter Company occupied spaces Nos. 121 and 123, and its prettily disposed exhibit comprised the following apparatus: Devices for determining the illuminating power of gas; a 60-inch bar photometer, a Lowe jet photometer and a Sugg illuminating power meter. Analytical apparatus: A set of standard sulphur and ammonia apparatus complete, with all necessary glass ware, etc., and a wet test meter with automatic 10-ft. stop attachment and double dry governor, mounted on a handsome adjustable stand; Wilkinson apparatus for qualitative and quantitative analysis of gas; a sulphur and ammonia test burner, with $CO_2$ attachment; and a complete set of specific gravity apparatus. The display of apparatus for recording pressure and testing for same included three sizes of pressure registers; King's gauges for pressure and vacuum; a complete line of siphon gauges, from 4 inches to 24 inches; straight and bent condenser thermometers and arch gauges. The miscellaneous apparatus included burner test meters, drip pumps, service cleaners, portable test meters for testing meters *in situ*, and several handsome and true working specimens of prepayment meters. A feature of this exhibit was the large show meter displayed at the Centennial Exhibition, Philadelphia, 1876, by Messrs. W. W. Goodwin & Co.

The display of Messrs. John J. Griffin & Co., of Philadelphia, was made in space No. 157, and was largely devoted to an exposition of the merits and working of their prepayment meters, which were shown in 3, 5 and 10-light samples. The exhibit also included a well-arranged collection of ordinary meters, from 3 to 300 lights capacity.

Messrs. Helme & McIlhenny, who occupied space No. 158, set their goods out in such a clever manner that their booth was never without visitors. The magnet of their display was in the shape of a 3-light prepayment meter, the money box of which was adjusted to a one cent basis (with gas at the rate of $2 per 1,000), so that the public might judge of the accuracy of the meter as a measurer of gas. The meter fed 8 large jumbo burners, and the ordinary gas consumer, having put a cent in the slot, could hardly credit the fact, as he watched the burners light up and in due time, and with mathematical precision, become extinguished, that all that illumination had been obtained from the investment of a cent. Other interesting exhibits were: A meter constructed in a glass case, to show almost at a glance the building and working of the ordinary consumers' meter; prepayment meters adjusted for 5-cent and 25-cent coins, and in 3, 5, 10 and 20-light sizes; a Lowe improved jet photometer, and a Foulis gas governor.

The Buhl Stamping Company, of Detroit, Mich., which occupied spaces Nos. 76 and 77, maintained a goodly show of its wares, which consisted mainly of meters of the ordinary type.

The Maryland Meter and Manufacturing Company, of Baltimore, occupied several spaces (Nos. 145 to 146 and 150 to 152) for the display of its specialties. The characteristic feature of the display was a handsome pyramid of meters, occupying the center of its floor space, the base of the pyramid being a 300-light meter, and tapering to the apex, the latter being a 3-light. There were also shown: Glazed meters of square pattern; and a meter of recent invention, to register gas consumed during each hour of the day—this device attracted much attention from the visiting gas men; a full line of "Perfect" gas stoves and ranges, which were especially attractive to the fair sex, who kept "Fred." Persons busy explaining the merits of the "Perfect" cookers; a recording meter prover, the invention of Mr. B. E. Chollar, of St. Louis, Mo.—the device proves by revolution of tangent, showing valve movement and accuracy of construction of meter. There was also shown a sample of the Heller heater manufactured by J. P. Sadtler, of Baltimore, Md., designed for the economical heating of water boilers. Another novelty shown was the J. R. Power combination cutter and dater.

## Deep Mining for Coal.

The London *Journal* "notes" that a Mr Brough has recently discussed the subject of mining at great depths, with regard to its bearing upon the question of the duration of the British coal supply. He was moved to broach the subject by the recent announcement that the Red Jacket shaft of the Calumet and Hecla mine in the Lake Superior copper region has been sunk to a depth of 4,900 feet—the greatest depth ever reached by a mine shaft. The deepest shaft in the United Kingdom is that of the Ashton Moss Colliery, near Manchester, which has attained a depth of 2,880 feet. The seams dip at the rate of 9 inches per yard, so that parts of the workings are vouched for by Mr. T. H. Wordsworth, of the New Moss Colliery, as being 3,360 feet deep. Even this has been exceeded at the Pendleton Colliery, according to Mr. Israel Barker, the manager, where an incline of 1 in 3 has been sunk to a length of 4,700 feet from the bottom of the shaft, which is 1,575 feet deep. The greatest vertical depth attained here is, therefore, 3,474 feet. Many other deep shafts are more than 1,800 feet, while the workings extend to upwards of 2 miles from the shaft. In Belgium, the Produits Colliery, at Mons, is 3,937 feet deep. Other examples are cited to show that a great many of the difficulties which were formerly connected with the sinking and working of deep shafts have now disappeared. The valuable inventions and appliances available by mining engineers have rendered such sinking operations easy and comparatively inexpensive. Mr. Brough concludes, therefore, that no considerations of a mechanical nature need limit the prospective depths of shafts. The elements needing consideration are the decreasing capacity of the output of deep shafts, and the increase of pressure, temperature and expenditure. The invention of wire rope, ascribed to Oberbergrath Albert, in Clausthal, in 1833, rendered deep mining possible. For very deep mining, pneumatic hoists are likely to take the place of ropes. The increase of temperature in deep mines is to be reckoned with. Mr. Brough concludes that as the shallow seams become exhausted, the rate of production will decline; and if the demand continues, the selling price must undoubtedly increase.

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MONDAY, MARCH 8, 1897.

## The Market for Gas Securities.

Firmness was the characteristic of the market for city gas shares since last time of writing, all classes of local securities having been in good demand at quite an advance in prices. Consolidated sold up to 154½ ex div. of 2 per cent., which is payable on the 15th inst., and New York and East River common went to 48 bid. The opening price in Consolidated to-day was 153 to 153½. The adjournment of the Assembly over inauguration week caused a lull in gas legislation, although the Senate, which remained in session, contributed its quota in that direction. Mr. Coggeshall introduced a bill, grading the selling rates in cities having populations of 800,000 or over, on a 5-cent concession yearly per 1,000 until the $1 limit is reached. This bill, together with the fact that the Brooklyn Board of Aldermen accepted the 5-year scaling proposition, submitted by the Brooklyn Union Company for gas to be supplied on public and private account (for the terms of the proposition, see JOURNAL, February 8th), and the further belief that the Legislature will not deal harshly with the Companies in any legislation as to prices that may be determined upon, are the causes for the increases in values.

Brooklyn Union advanced sharply, to 96, opening to-day at 95½ to 97. The bonds are 109½ to 109¾. Chicago gas is steady, which remark also applies to Baltimore Consolidated. Bay State is listless and weak. Cincinnati gas is well beyond the 200 mark, at 203½ to 205. According to our belief almost anything on the list looks a purchase, particularly in respect of Consolidated, of New York.

The San Francisco Gas and Electric Light Company's shares are quite strong, at 97½ to 98¼, which is an advance of 2 points over the first quotation made in them. Pacific Gas Improvement Company's shares are also in demand, at 91 to 92½.

## Gas Stocks.

**Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.**
35 WALL ST., NEW YORK CITY.
MARCH 8.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $35,480,000 | 100 | 153 | 153½ |
| Central | 500,000 | 50 | 195 | .. |
| " Scrip | 220,000 | .. | 100 | . |
| Equitable | 4,000,000 | 100 | 204 | 207 |
| Bonds, 6's | 1,000,000 | 1,000 | 105 | . |
| " 1st Con. 5's | 2,300,000 | 1,000 | 114 | . |
| Metropolitan Bonds | 658,000 | .. | 108 | 112 |
| Mutual | 3,500,000 | 100 | 230 | 235 |
| " Bonds | 1,500,000 | 1,000 | 100 | 102 |
| Municipal Bonds | 750,000 | . | .. | . |
| Northern | 150,000 | 50 | 85 | . |
| " Bonds | 150,000 | 1,000 | .. | 98 |
| New York and East River | 5,000,000 | 100 | 48 | 49 |
| Preferred | 2,000,000 | 100 | 78 | 79 |
| Bonds 1st 5's | 3,500,000 | 1,000 | 105 | 106 |
| " 1st Con. 5's | 1,500,000 | .. | 96¼ | 97 |
| Richmond Co., S. I. | 348,650 | 50 | 50 | .. |
| " Bonds | 100,000 | 1,000 | .. | .. |
| Standard | 5,000,000 | 100 | 78 | 80 |
| Preferred | 5,000,000 | 100 | [illegible] | . |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 110 | .. |
| Yonkers | 299,650 | 50 | 180 | . |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 95⅛ | 97 |
| " " Bonds (5's) | 15 000,000 | 1,000 | 100¼ | 100⅛ |
| Bay State | 15,000,000 | 50 | 10¾ | 11 |
| " Income Bonds | 2,000,000 | 1,000 | .. | 35 |
| Boston United Gas Co.— | | | | |
| 1s Series S. F. Trust | 7,000,000 | 1,000 | .. | 85 |
| 2d " " " | 3,000,000 | 1,000 | 70 | 72 |
| Buffalo Mutual | 750,000 | 100 | 125 | .. |
| " Bonds | 200,000 | 1,000 | 95 | 100 |
| Central, San Francisco | 2,000,000 | .. | 95 | .. |
| Chicago Gas Co. | 25,000,000 | 100 | 77 | 77⅛ |
| Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds | 7,650,000 | 1,000 | 94 | 94¼ |
| Columbus | 1,089,000 | .. | 68 | 70 |
| 1st Mortgage | 1,085,000 | .. | .. | 96 |
| Consumers, Jersey City | 2,000,000 | 100 | .. | 75 |
| " Bonds | 600,000 | 1,000 | 100 | 102 |
| Cincinnati G. & C. Co. | 8,500,000 | 100 | 203½ | 205 |
| Consumers, Toronto | 1,600,000 | 50 | 184½ | 187 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150,000 | 1,000 | .. | .. |
| Consolidated, Baltimore | 1,000,000 | 100 | 61 | 61⅛ |
| Mortgage, 6's | 3,600,000 | .. | 107 | 107½ |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490,000 | .. | .. | .. |
| Detroit | 4,000,000 | .. | 22 | .. |
| " Con. Bonds | 4,312,000 | .. | 78 | 78½ |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Fort Wayne | 2,000,000 | .. | 82 | 84 |
| " Bonds | 2,000,000 | .. | 91 | 93 |
| Hartford | 750,000 | 25 | .. | 145 |
| Indianapolis | 2,000,000 | .. | 130 | 135 |
| " Bonds, 6's | 2,650,000 | .. | 105 | 107 |
| Jersey City | 750,000 | 20 | 180 | .. |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | 84 | 88 |
| Bonds | 1,000,000 | 1,000 | 92 | 94 |
| Louisville | 2,570,000 | 50 | .. | .. |
| Laclede, St. Louis | 7,500,000 | 100 | 23 | 24⅛ |
| Preferred | 2,500,000 | 100 | 70 | 80 |
| Bonds | 9,034,400 | 1,000 | 95½ | 97 |
| Little Falls, N. Y. | 50,000 | 100 | .. | 100 |
| Bonds | 25,000 | .. | .. | 100 |
| Montreal, Canada | 2,000,000 | 100 | 200 | . |
| Newark, N. J., Gas Co. | 1,000,000 | .. | 98 | 98 |
| Bonds, 6's | 4,000,000 | .. | 123 | .. |
| New Haven | 1,000,000 | 25 | 225 | .. |
| Oakland, Cal. | 2,000,000 | .. | 53½ | 54 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,00 | 1,000 | .. | 108 |
| 2d " | 2,500,000 | 1,000 | 104 | 105 |
| Peoples, Jersey City | 500,000 | 50 | .. | 175 |
| Paterson, N. J. | ..... | 25 | 99 | 102 |
| Rochester Gas & Elec. Co. | 2,150,000 | 50 | .. | .. |
| Preferred | 2,150,000 | 50 | 88 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 97¾ | 98¼ |
| St. Paul Gas Light Co. | 1,500,000 | 100 | 67½ | 70 |
| 1st Mortgage, 6's | 650,000 | .. | 84 | 87 |
| Extension, 6's | 600,000 | .. | .. | .. |
| General Mortgage, 5's | 2,400,000 | . | 88 | 90 |
| Syracuse, N. Y. | 500,000 | 25 | .. | .. |
| Washington, D. C. | 2,000,000 | 20 | 250 | .. |
| Western, Milwaukee | 4,000,000 | 100 | 59 | 61 |
| Bonds, 5's | 3,556,000 | . | 90 | 91 |
| Wilmington, Del. | 500,000 | 50 | 180 | 182 |

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## DIVIDEND NOTICE.

OFFICE OF WELSBACH COMMERCIAL COMPANY,
40 WALL ST., NEW YORK CITY, Feb. 11, 1897.

The Directors have this day declared a quarterly dividend of two (2) per cent. on the preferred stock, payable on Mar. 10, 189', to stockholders of record at the close of business Feb. 27. The Transfer books of the preferred stock will be closed from Feb. 28 to Mar. 10, both inclusive. Checks will be mailed.

1133-3 EDWARD C. LEE, Treasurer.

## Main Layer Wanted at Once.

An experienced man to take charge, under direction of Superintendent, of a 5-mile extension of mains.

HACKENSACK GAS & ELECTRIC CO.,
1135 1t Hackensack, N. J.

## WANTED,

A young man, with up-to-date ideas, for making Gas Stoves and Lights popular, to take charge of such department, or as Manager of a small works, with the determination of increasing the output. Address

1135-1t "O.," care this Journal.

## Position Wanted,

**As Engineer or Gas Maker,**

By a young man who has had 13 years' experience with Water Gas. Is thoroughly acquainted with the manufacture and distribution of the same, and can furnish good references. Is not afraid to work. Address

H. D. JONES, No. 521 Montgomery Street,
1135-2t Pittston, Luzerne Co., Pa.

## ENGAGEMENT DESIRED,

**As Manager or Superintendent of Gas or Gas and Electric Light Works.**

Thoroughly competent and reliable. Address

1129-bteow "ENGINEER," care this Journal.

## ENGAGEMENT DESIRED

**As Supt. of Gas (Coal or Water) or Gas and Electric Light Works.**

Best of references. Ten years' experience gas; fifteen years' combination. Address

HOWARD A. BROOKE,
1133-5 Saratoga Springs, N. Y.

## Position Desired

**As Superintendent of Gas Works or Gas and Electric Light Works,**

By a man 34 years of age. Sixteen years' experience in the manufacture and distribution of Coal Gas as Supt., and four years in the Electric line. Thoroughly competent to take charge of any plant, separately or combined. A practical mechanic, and understands the erection of gas plants and everything pertaining to the business. Not afraid of work. Salary no object until ability is proven. Best of references.

1102-tf Address "M. E. J.," care this Journal.

## WANTED,

Position to take full charge of works, or Superintendent of Manufacturing and Distribution. Seven years' experience in pushing the stove business. At present in charge of works sending out 16,000,000 cu. ft. annually. Twenty per cent. increase in business over year 1895, accomplished through sale of stoves and Welsbach lights. Thirty-seven years old; 21 years in all branches of the gas business. Coal gas works preferred. Reason for desiring change, better school system. Gas Companies and well-known Gas Engineers as references. Salary reasonable. Address

1134-tf "M. L. H.," care this Journal.

## FOR SALE.

On account of changing location of our works and purchase of larger holder, we have for sale a Single-lift **Gasholder,** 80 x 20 feet, capacity 100,000 cubic feet. Complete and as good as new. Now in brick tank. Built by Stacey Mfg. Co in 1880. Holder has cup on bottom for telescoping, and guide framing is arranged and punched for additional section. Can be taken down and re-erected in brick or steel tank, as may be desired. Will be sold cheap.

THE AKRON GAS COMPANY,
1129-14t Akron, Ohio.

## FOR SALE,

**One 8-Foot Station Meter, with 12-Inch Connections.**

In good order and in use. Address

1127-tf NEW HAVEN (CONN.) GAS LIGHT CO.

## For Sale.

**A Small Gas and Electric Light Plant,**

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,
1097-tf Fort Wayne, Ind.

## FOR SALE.

**Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids,** for four Benches of 5's and for one Bench of 3 retorts.

**Two Coolers, or Air Condensers,** each of 150 000 cubic feet capacity.

**Multitubular Condenser,** shell, 36 in. diameter, with 98 2-in. tube-, 10 ft. 6 in. long.

**D-Shaped Tar Extractor,** 8 ft. long, 1 ft. 6 in. deep.

**Scrubber,** 48 in. diameter, 11 ft. 9 in. high. Three manholes, 11 in. by 15 in.

**S-inch Center Seal. Four Purifiers,** 8 ft. x 6 ft.

KEY CITY GAS CO.,
1119-tf Dubuque, Iowa.

**Mistakes in Addition, Office Headache,**

and mistakes in carrying forward don't occur where the Comptometer is used. It saves half the time in doing the work and all time looking for errors. Solves with great rapidity and absolute accuracy all arithmetical problems. Write for pamphlet.

FELT & TARRANT MFG. CO.,
52-56 ILLINOIS ST., CHICAGO.

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**A SPECIALTY.**

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Consolidated of New Jersey,
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Madison,
Milwaukee,
Grand Rapids,
New York,
Syracuse,
St. Paul.

**GUSTAVUS MAAS,**

Telephone, 2137 Cortlandt. 26 Broad St., N. Y.

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Special Trays for Iron Sponge or Oxide of Iron,
**CHURCH'S TRAYS a Specialty.**
Reversible, Strongest, Most Durable, Most Easily Repaired.

553-557 West Thirty-third Street, New York.
We also make the Cheapest and Strongest
REVERSIBLE BOLTED TRAYS IN THE MARKET.
*Send for Circulars.*

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**Patent Lava Gas Tips.**

UNIFORMITY GUARANTEED.
ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

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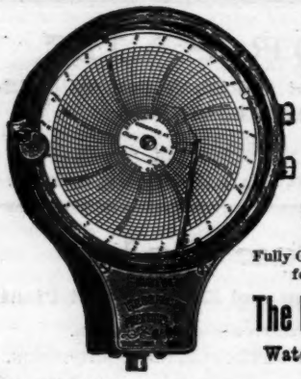

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**PRESSURE GAUGE.**
For continuous records of **Street Gas Pressure**
Simple in Construction, Accurate in Operation Low in Price.
Fully Guaranteed. Send for Circulars.

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Waterbury, Conn.

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(Established 1870.)
SOLE MANUFACTURER OF THE
Trade Mark Trade Mark
**Maxim & Clough Adjustable Gas Burners**
Reg. Reg.
E. H. Nickel Tips for Water Gas a Specialty.
**THEO. CLOUGH, - - Dobbs Ferry, N. Y**

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**Utilize Your Gas Liquor.**
NO EXTRA LABOR OR OPERATING EXPENSES.
**Ammonia Concentrator.**
Not Expensive. Write to
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Mich. Ammonia Works, Detroit, Mich

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## Our Mica Chimneys

Etched Chimneys to Order.

**For Welsbach Lights**
ARE THE
**BEST IN THE WORLD.**
Get Catalog and Discounts.
**The MICA MFG. CO**
Micasmiths,
**88 Fulton Street, N. Y. City.**

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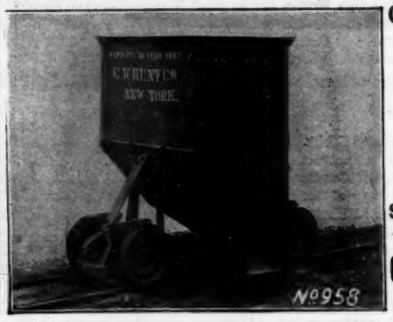
## C. W. HUNT COMPANY.




COKE CARS for Gas Works,
TIP CARS for Carrying Ashes,
CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.
**INDUSTRIAL RAILWAYS**
Specially designed for handling material in and around
Gas Works, Coal Yards, Factories, Etc., Etc.
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## The Pioneer Vertical Water-Tube Boiler of the World!

**THE HAZELTON OR PORCUPINE BOILER.**

After Sixteen Years of Active Service in all the Principal Industries, this Boiler has Proven Itself Superior to all Others in Economy of Fuel, Durability, Safety and General Efficiency.
NO EXPLOSIONS OR ACCIDENTS OF ANY KIND.
**Correspondence Solicited.**

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Sole Proprietors and Manufacturers,
Cable Address, "Paila," New York. Tele., "1229-18th St.," New York. Gen'l Office, 716 E. 13th St., N.Y., U.S.A.

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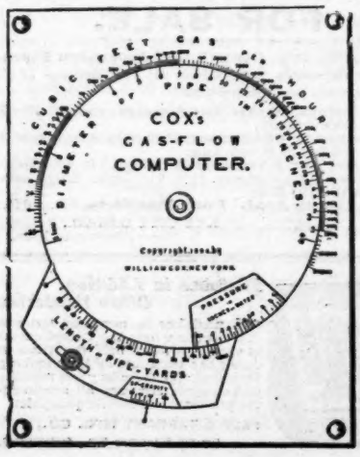



# Cox's Gas Flow Computer.

1. It gives at a glance the discharge of gas from pipes 1 to 48 inches in diameter and 10 to 10,000 yds. long, for any pressure from 0.01 to 10.0 inches of water, and any specific gravity from 0.40 to 1.00.
2. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is at once seen.
3. When the required discharge and the length of pipe are given, the pressure corresponding to any diameter is at once found.
4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.

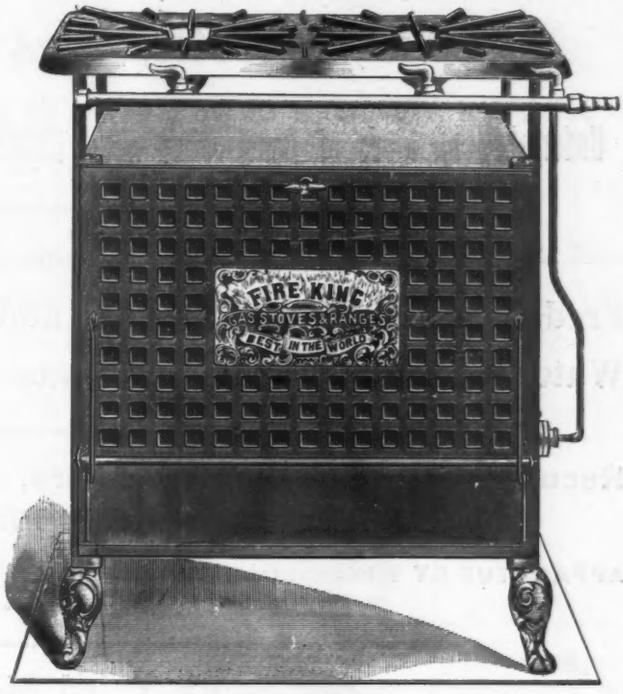
**Price, $5.00, per Registered Mail.**

For sale by

**A. M. CALLENDER & CO., 32 Pine St., N. Y. City.**

# LOW PRICED GAS RANGES.

Just the thing for these Hard Times. Will cook for a large family. Write for catalogue and discounts. A full line of all kinds of Gas Stoves and Ranges.




**A. WEISKITTEL & SON,**
Factory: BALTIMORE, MD.

NEW YORK BRANCH:
1387 BROADWAY, N. Y.

NEW ENGLAND AGENCY:
WALDO BROS., Boston, Mass.

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THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.

**Pipe Cutting Tool**

For Cutting Cast, Wrought Iron, Gas & Water Pipes.

**WM. ANDERSON,**
425 Meridian Street,
East Boston, Mass., or

**WALDO BROS.,**
88 Water Street, Boston, Mass.

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**F. BEHREND,**
SOLE IMPORTER OF THE CELEBRATED
**German (Stettin-Didier) Clay Gas Retorts,**
BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,
Stettin "Anchor" & "Eagle" Brand Portland Cement
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THE GREATEST IMPROVEMENT IN GAS LIGHTING
Has been made by
WILDER'S VOLUMETRIC GOVERNORS.
They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.
**WELSBACH LIGHTS** are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.
THE WILDER MANFG. CO., - - 818 Cherry St., PHILADELPHIA.

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# RITER & CONLEY, PITTSBURGH, PA.

## GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

**STEEL ROOFS and BUILDINGS.**

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

# AMERICAN GAS COMPANY

**Owns, Operates, Buys and Leases Gas Works.**

**Undertakes all Kinds of Construction Work, Especially for the Manufacture of Gas from Caking Coal.**

EASTERN AGENTS FOR

**Fred. Bredel's System of Coal and Water Gas Plants and Gas Apparatus**

**P. H. & F. M. ROOTS CO.'S** Exhausters, Blowers, etc.

**Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, etc,**

**APPARATUS BY WHICH COAL GAS CAN BE BROUGHT UP TO 22 or 24 CANDLE POWER, MAKING A WHITE LIGHT THAT WILL BURN WITHOUT SMOKING.**

**222 South Third Street, Philadelphia, Pa.**

**GEORGE G. RAMSDELL, General Manager.** Correspondence Solicited

# FRED. BREDEL, C.E.

## Coal and Water Gas Plants,

**OWN SYSTEM.**

**Recuperative Furnaces, Washers, Condensers, Purifiers, Purifying Machines.**

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

COMPLETE GAS WORKS, COKE CONVEYERS, ETC.

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# P. H. & F. M. ROOTS CO.

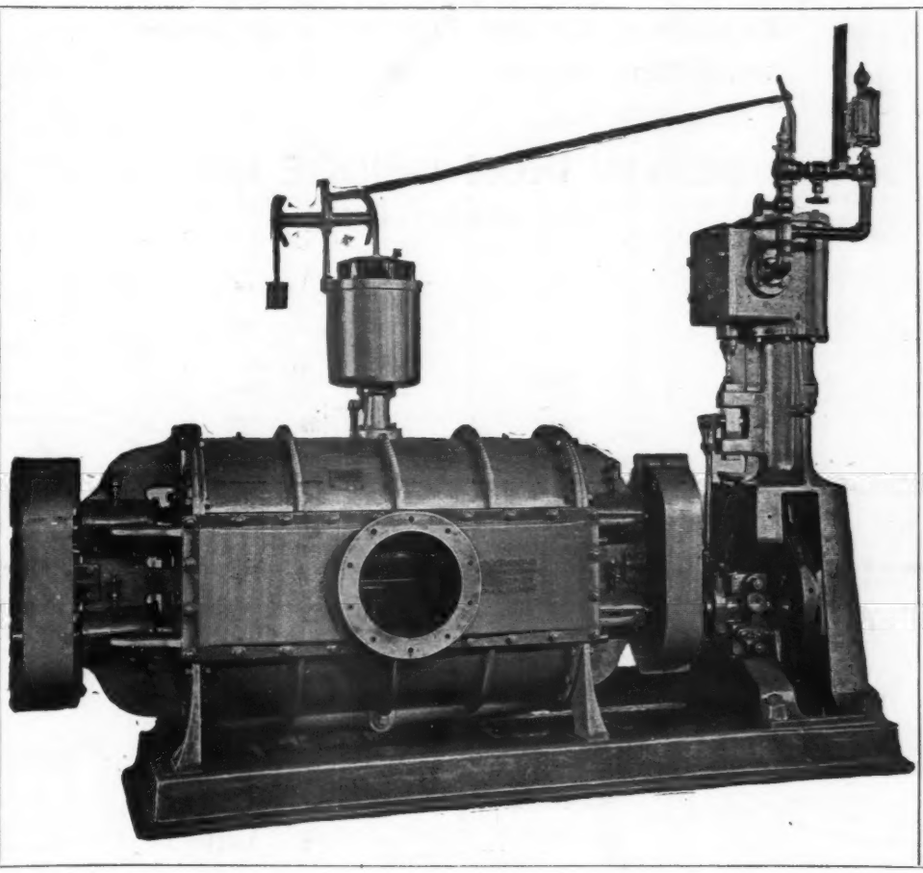
Beg to announce they have completed arrangements by which the

## AMERICAN GAS COMPANY,

222 SOUTH THIRD STREET, - PHILADELPHIA, PA.,

Become their Eastern Agent, and will have exclusive control of the territory, embracing New York, New Jersey, Pennsylvania and New England, for the sale of Exhausters and kindred machinery. The New York Agency will be continued for the sale of the ROOTS' BLOWER.

**New Design of Direct Connected Engine and Exhauster on Same Bedplate.**



**This Design is Used for all Exhausters from No. 7 to No. 10, Inclusive.**

**Write for Illustrated Catalogue.**
**Estimates submitted on application.**

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Connersville, Indiana.

New York Office, 109 Liberty Street, J. B. STEWART, Manager.

# Iron Building For Sale.

Dimensions, 87 feet in width, 225 feet in length, one story in height. Designed for a Machine Shop, but, owing to the failure of the purchaser, is now offered for sale at a bargain. Is admirably adapted for a Machine Shop, Car Barn, Paper Mill, or any general manufacturing purposes.

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WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

# THE MANAGEMENT OF SMALL GAS WORKS.

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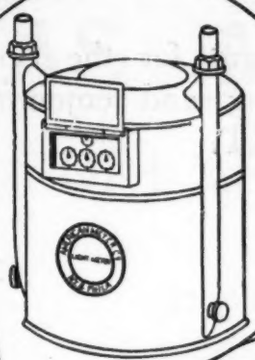
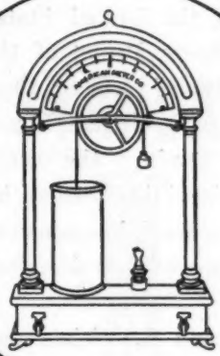
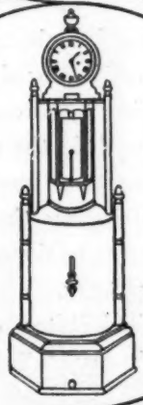
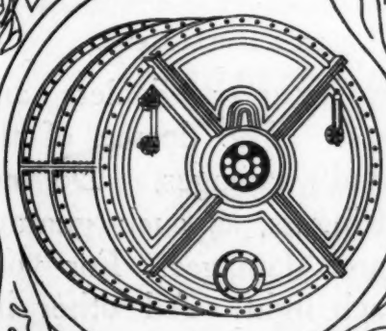
Price $1.

A. M. CALLENDER & CO., No. 32 Pine Street New York.









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# AMERICAN METER CO.

ESTABLISHED 1836. INCORPORATED 1868.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

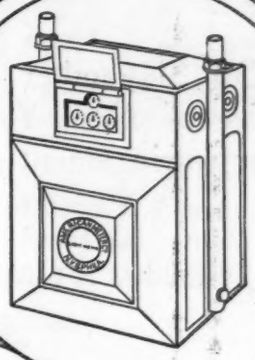
## PUBLIC LIGHTING TABLE.

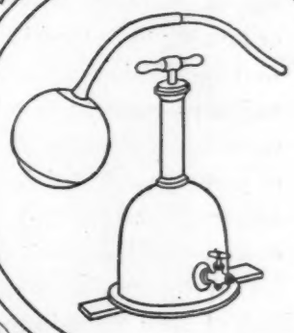
### MARCH, 1897.

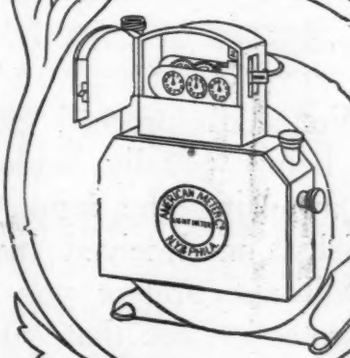
| Day of Week. | Date. | Table No. 1. Following the Moon. Light. | Table No. 1. Following the Moon. Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Table No. 2. New York City. All Night Lighting. Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Mon. | 1 | 6.20 PM | 5.30 AM | 5.30 | 5.45 |
| Tue. | 2 | 6.20 NM | 5.30 | 5.30 | 5.45 |
| Wed. | 3 | 6.20 | 5.30 | 5.30 | 5.45 |
| Thu. | 4 | 6.20 | 5.30 | 5.30 | 5.45 |
| Fri. | 5 | 6.20 | 5.30 | 5.40 | 5.35 |
| Sat. | 6 | 6.20 | 5.30 | 5.40 | 5.35 |
| Sun. | 7 | 9.30 | 5.20 | 5.40 | 5.35 |
| Mon. | 8 | 10.30 | 5.20 | 5.40 | 5.35 |
| Tue. | 9 | 11.30 | 5.20 | 5.40 | 5.35 |
| Wed. | 10 | 12.30 AM | 5.20 | 5.40 | 5.35 |
| Thu. | 11 | 1.20 FQ | 5.20 | 5.40 | 5.35 |
| Fri. | 12 | 2.00 | 5.20 | 5.50 | 5.20 |
| Sat. | 13 | 2.40 | 5.20 | 5.50 | 5.20 |
| Sun. | 14 | 3.20 | 5.10 | 5.50 | 5.20 |
| Mon. | 15 | 3.50 | 5.10 | 5.50 | 5.20 |
| Tue. | 16 | 4.20 | 5.10 | 5.50 | 5.20 |
| Wed. | 17 | No L. | No L. | 5.50 | 5.20 |
| Thu. | 18 | No L. FM | No L. | 5.50 | 5.20 |
| Fri. | 19 | No L. | No L. | 6.00 | 5.10 |
| Sat. | 20 | 6.40 PM | 9.50 PM | 6 00 | 5.10 |
| Sun. | 21 | 6.50 | 11.10 | 6.00 | 5.10 |
| Mon. | 22 | 6.50 | 12.30 AM | 6.00 | 5.10 |
| Tue. | 23 | 6.50 | 1.40 | 6.00 | 5.10 |
| Wed. | 24 | 6.50 LQ | 2.40 | 6.00 | 5.10 |
| Thu. | 25 | 6.50 | 3.30 | 6.00 | 5.10 |
| Fri. | 26 | 6.50 | 4.10 | 6.10 | 4.55 |
| Sat. | 27 | 6.50 | 4.40 | 6.10 | 4.55 |
| Sun. | 28 | 6.50 | 4.50 | 6.10 | 4.55 |
| Mon. | 29 | 6.50 | 4.50 | 6.10 | 4.55 |
| Tue. | 30 | 6.50 | 4.50 | 6.10 | 4.55 |
| Wed. | 31 | 6.50 | 4.50 | 6.10 | 4 55 |

### TOTAL HOURS LIGHTING DURING 1897.

| By Table No. 1. | Hrs.Min. | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January | 233.00 | January | 423.20 |
| February | 187.20 | February | 355.25 |
| March | 202.00 | March | 355.35 |
| April | 170.40 | April | 298.50 |
| May | 163.00 | May | 264.50 |
| June | 140.40 | June | 234.25 |
| July | 151.40 | July | 243.45 |
| August | 167.30 | August | 280.25 |
| September | 174.40 | September | 321.15 |
| October | 200.00 | October | 374.30 |
| November | 205.20 | November | 401.40 |
| December | 220.10 | December | 433.45 |
| Total, yr. | 2216.00 | Total, yr. | 3987.45 |







# INJUNCTION ISSUED AGAINST INFRINGERS.

On September 23d the United States Circuit Court for the Southern District of New York granted an injunction restraining and enjoining the further infringement of our Welsbach patent. READ IT.

UNITED STATES CIRCUIT COURT,
Southern District of New York.

WELSBACH LIGHT COMPANY,
vs.
A. LIEBES.
} IN EQUITY.

*The President of the United States,*

TO A. LIEBES, and his servants, agents, attorneys and workmen, GREETING:

WHEREAS, It has been represented to us in our Circuit Court of the United States for the Second Circuit and Southern District of New York, that Letters Patent of the United States No. 438,125, were issued in due form of law on the 7th day of October, 1890, to Carl Auer von Welsbach, assignor of the complainant, then known as "Welsbach Incandescent Gas Light Company of New Jersey," and that the complainant herein is the owner of said Letters Patent, and that you, the said A. Liebes, have infringed the rights secured by the aforesaid Letters Patent, by making, using and selling to others to be used, incandescent devices for gas burners, embodying and containing the invention and improvements described and claimed in said Letters Patent No. 438,125.

NOW, THEREFORE, We do strictly command and enjoin you, the said A. Liebes, and your attorneys, agents, servants and workmen, under the penalties which may fall upon you in case of disobedience, that you forthwith and forever desist from directly or indirectly making, or causing to be made, delivering, vending, or causing to be sold, offering for sale, using, or causing to be used in any manner, any incandescent devices for gas burners, like, or similar to those which you have heretofore made, used or sold, containing or embodying the invention and improvements described in said Letters Patent No. 438,125, and claimed in the claim thereof, and from counterfeiting or imitating the said invention or improvements or any part or parts thereof, and from in any manner or way whatsoever, violating or infringing the said Letters Patent No. 438,125 and the claim thereof, and from doing, or causing to be done, any other act or thing whatsoever in infringement of the said Letters Patent No. 438,125.

WITNESS, The Honorable Melville W. Fuller, Chief Justice of the United States, at the City of New York, in the Southern District of New York, this twenty-fourth day of September, A. D., 1896.

(SEAL) JOHN A. SHIELDS, Clerk.

(Endorsed) U. S. Circuit Court, Southern District of New York, in Equity.—Welsbach Light Company vs. A. Liebes. Injunction.

A Copy of a Writ of Injunction this day issued out of my office. JOHN A. SHIELDS, Clerk.

We shall proceed against all infringers; manufacturers, dealers and users being equally liable to injunction and damages. The decree of the court awarding the injunction also awards profits and damages. Do not be misled or deceived by guarantees offered by infringers, as such guarantees will not protect you against suit, injunction and damages. For your own protection see that you get the genuine Welsbach light. All other incandescent gas lights are infringements.

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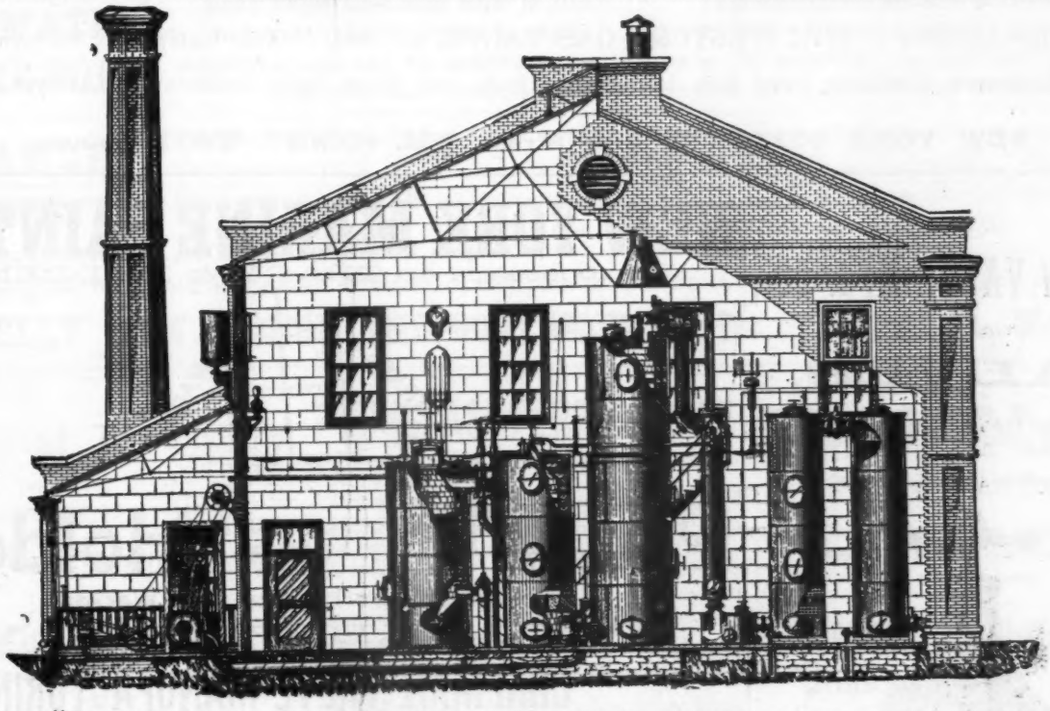

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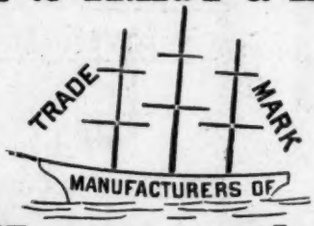


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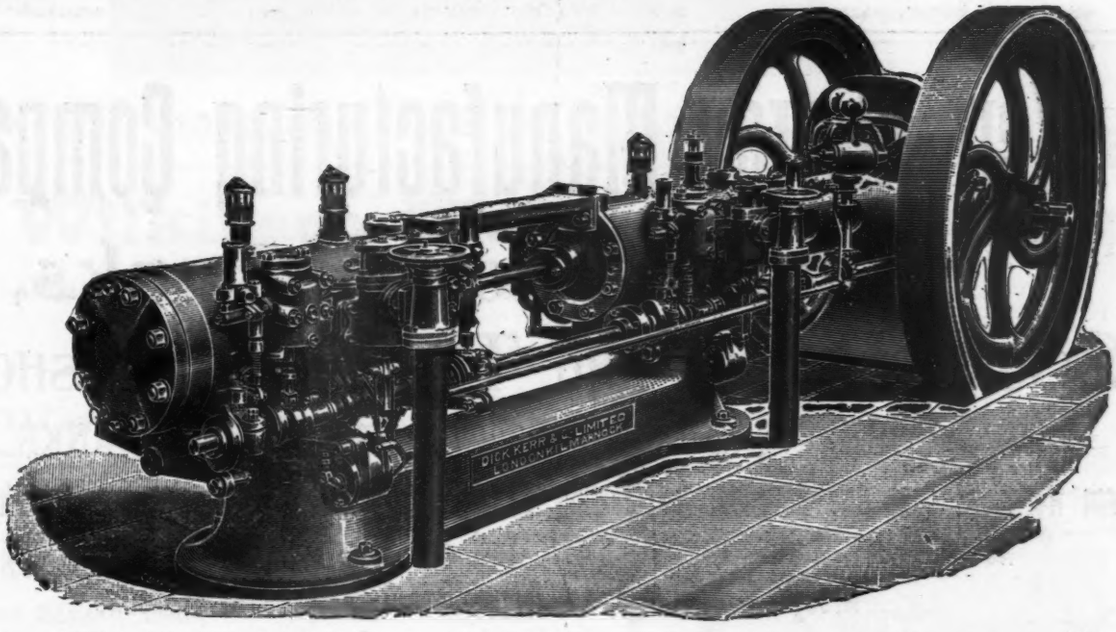


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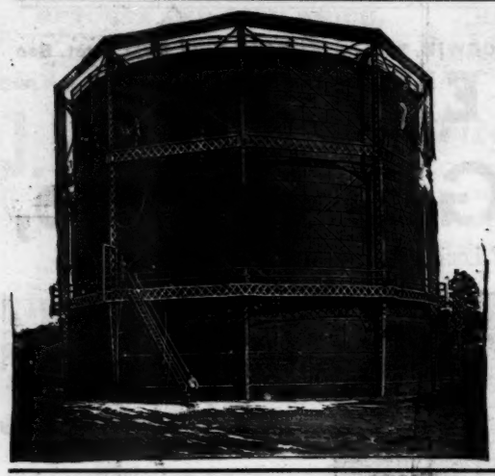

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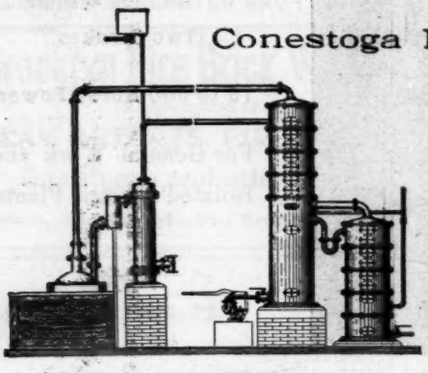

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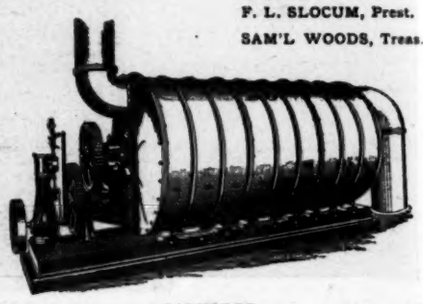

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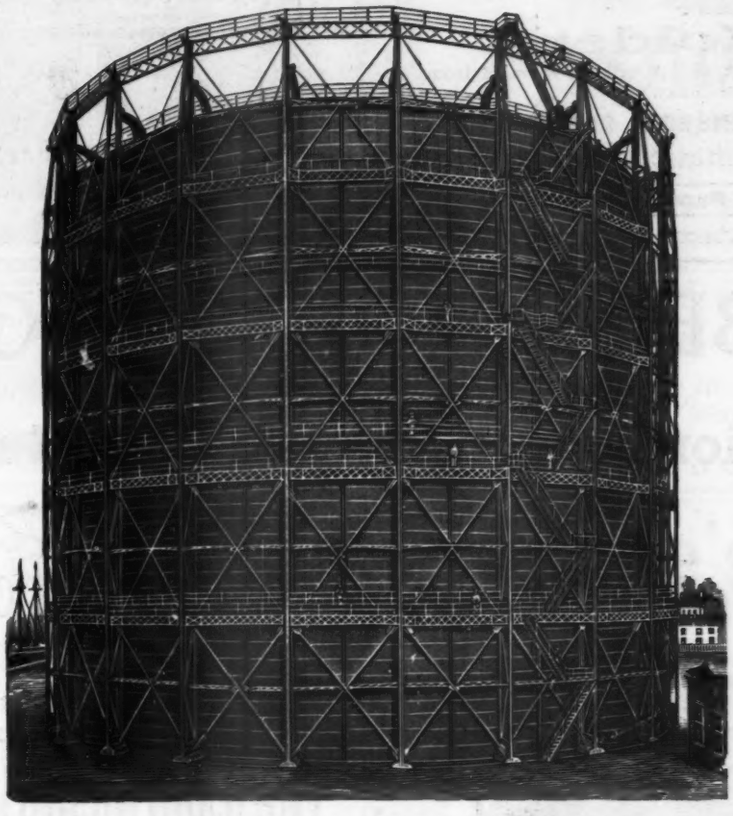

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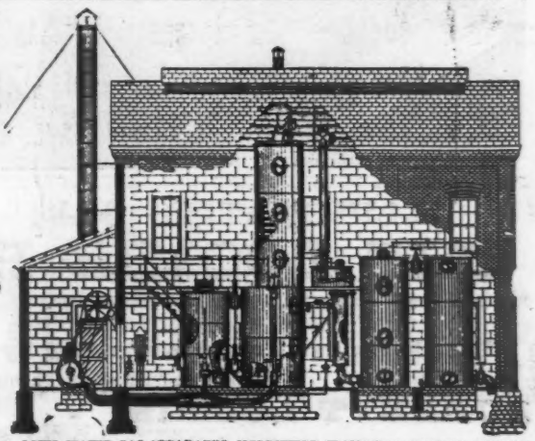

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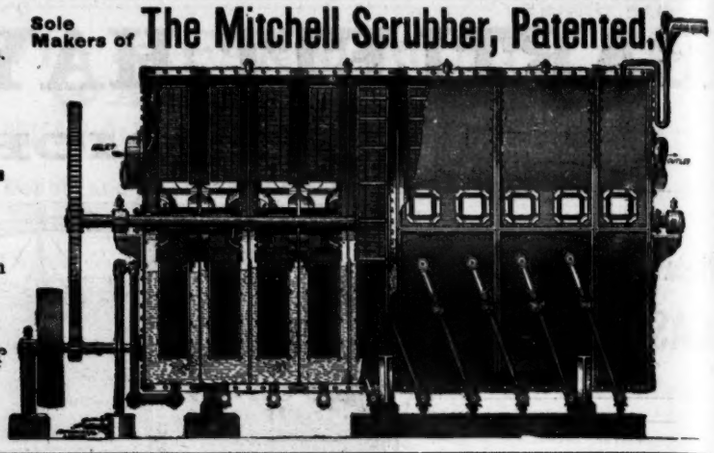

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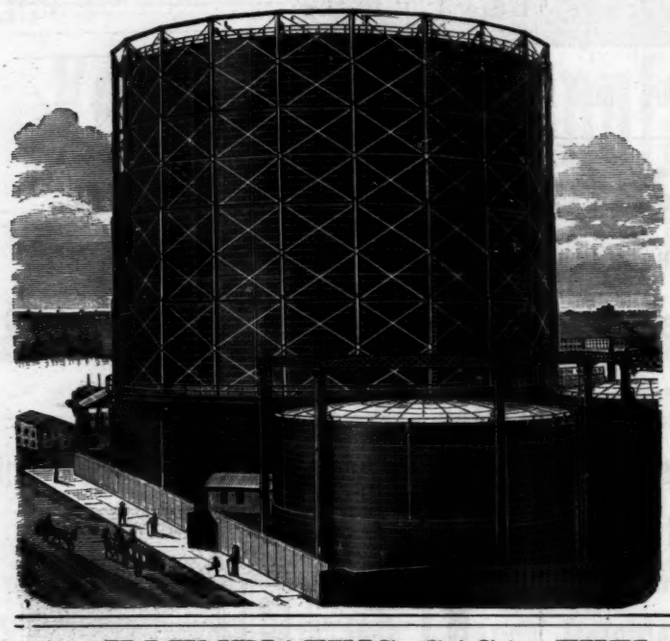

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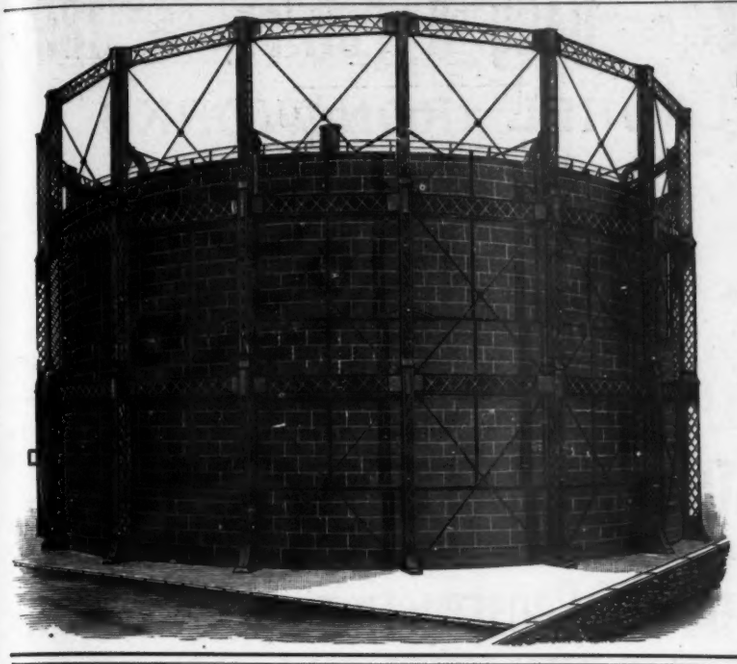

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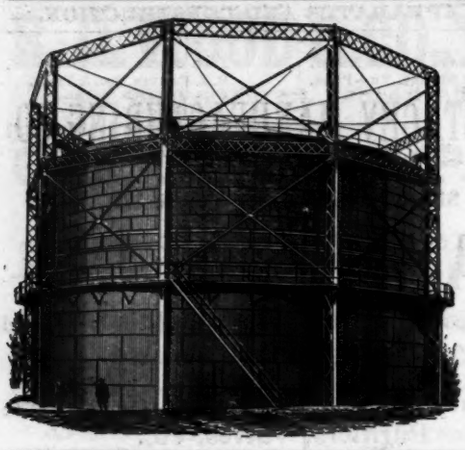

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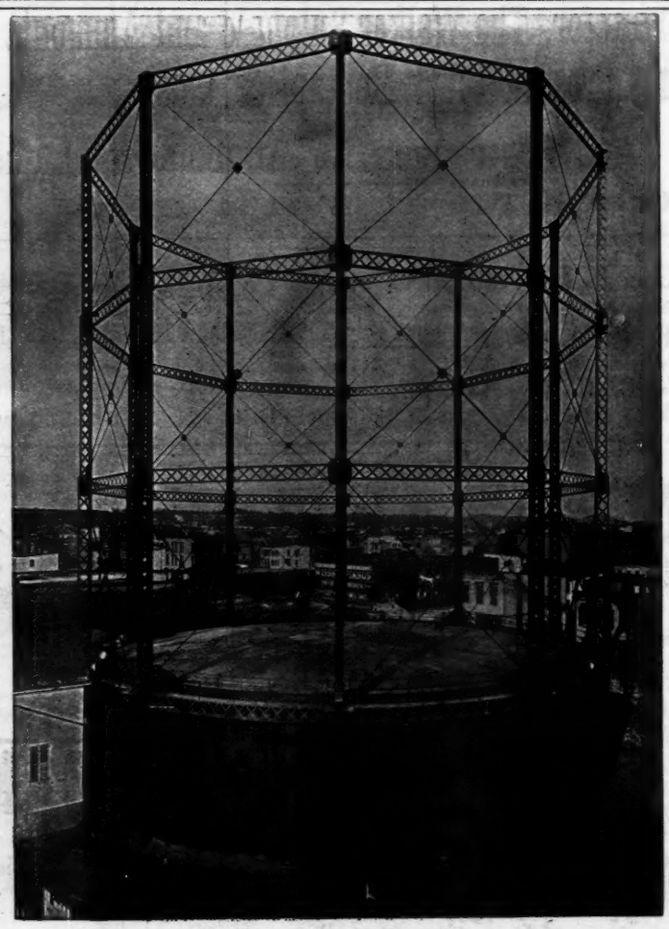

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